JUN 13 1921

Electrical World

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Electrical World

New York, Saturday, June 11, 1921

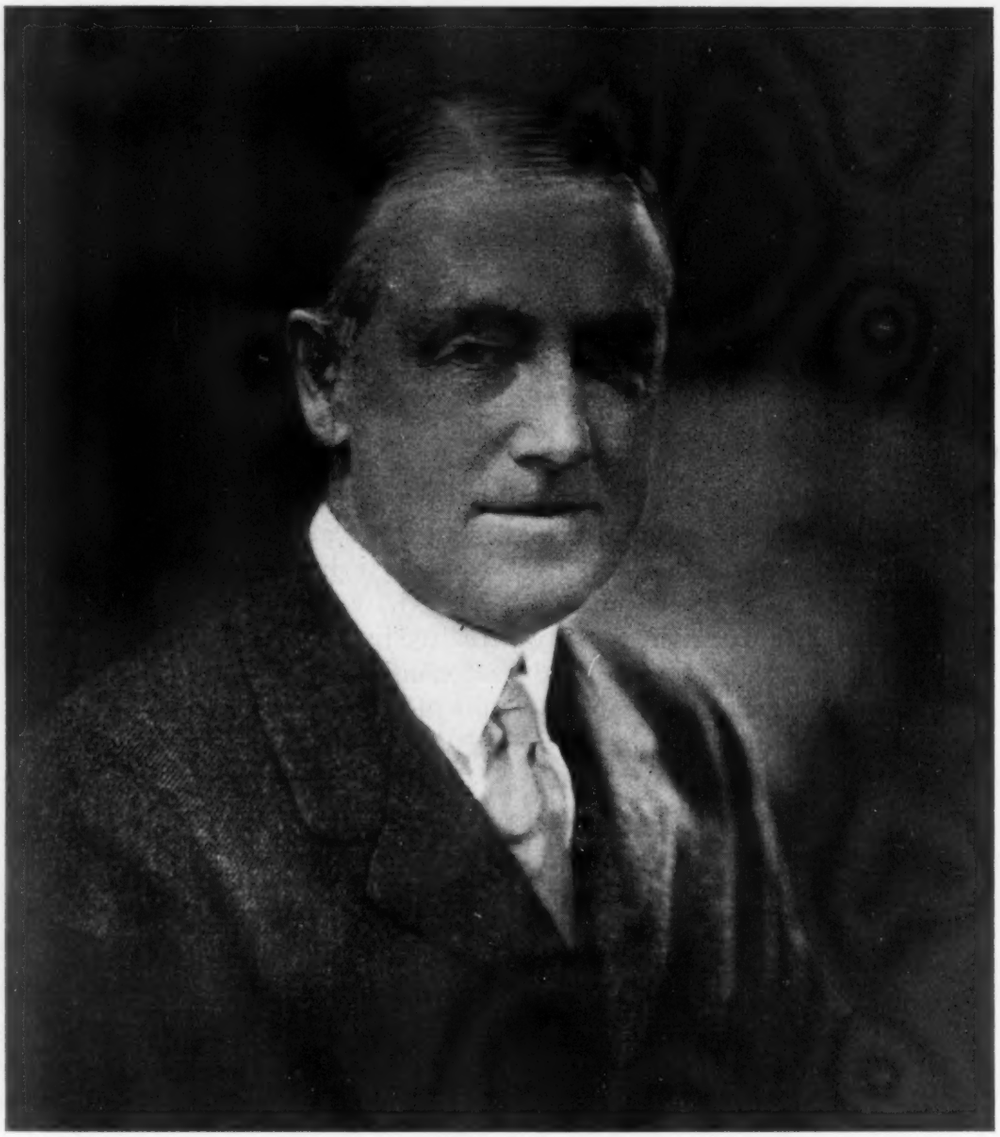
The Unique Economic Position of the Electrical Industry

EVERY electrical man is a booster for his industry. He believes that it is the greatest industry in the whole wide economic world. He feels that his future as an electrical man promises opportunity unparalleled in any other science, profession or trade. And he is right. It is well, however, to consider the causes and conditions of these things. It helps us work with a better background and a better prospect.

There are several kinds of industries. First, there are those that furnish the basic staples of life—food, clothes and shelter. These are the great necessities. Their market never fails. But man does not live long by bread alone, and so balanced against them we have the great, varied industries that produce the assorted luxuries of life. And in the mass their market seldom fails either, for in the world is so much wealth spent by so many people. These two groups, with the other industries of service—like transportation—that contribute broadly to them both, make up the bulk of the industrial world. Each meets and measures its own conditions for and against prosperity.

The electrical industry, however, holds a unique position. It sails a course that cuts across them all. Our product is not a true necessity, for within our memory men lived long and happily without it; and yet electric service today plays a large part in the manufacturing of necessities. Neither is it in the true luxury class, though it helps produce the luxuries. Electricity, in all its applications, is in reality just a comfort, a convenience, an economy. Be it light, heat or power, in industrial, commercial or domestic service, this is what it is. It is a comfort. It is a convenience. It is an economy. It brings safety. It brings cleanliness. It brings time saving, labor saving and improved efficiency. And it has so established these comforts and economies in our lives that they have come to be necessities, and the influence of electric service is recognized as one of the greatest impulses for civic growth and betterment.

The electrical industry, therefore, stands in a wonderful position. It has economic stability. It has already, though young in years, gained a scope and volume that indicate a future staggering to the imagination. It is organized on a high intellectual plane to which the inventive mind, the scientific mind, the engineering mind and the financial mind have contributed the background and the machinery for progress. It has prestige. It has prosperity. It has strength and power. Therefore, know more of it, have more from it, be more in it and do more for it.



Edwin Sibley Webster

Whose constructive service and financial judgment in the organization and sound development of public utilities typifies the best traits of American business leadership

GREAT financial acumen, combined with a fundamental engineering training and rich experience, has long since made Edwin S. Webster one of the outstanding national figures in public utility management. Inspired by a finely tempered enthusiasm, he realized the possibilities of centralized management early in the period when it began to be seen what the co-ordinated administration of electric railway, lighting and power properties could accomplish in contrast with the individual direction of company business. Mr. Webster has never lost this enthusiasm as the magnitude of his interests has increased, and his executive ability, grasp of economics and rare banking judgment have had an influence beyond measurement in the affairs of Stone & Webster, Inc., and in the many corporations.

Born at Boston, Mass., in 1866, Mr. Webster was graduated in electrical engineering from the Massachusetts Institute of Technology in 1888. After a year in the banking house of Kidder, Peabody & Company, Boston, he and Charles A. Stone established in that city the consulting engineering firm of Stone & Webster. At this time the electrical art was still in its infancy and it took no small amount of courage to believe in the future. Many electric light and power companies as well as other utilities because of haphazard financing and for other reasons did not prosper. Reorganizations became necessary and the services of this firm were sought. Today this great organization occupies a world-wide field in finance, engineering, construction and utility management. The capitalization of public utilities under its management totals approximately three hundred millions of dollars.

Mr. Webster and his partner have never been contented to confine their engineering activities within any prescribed bounds. Examples of their skill may be found in almost every state of the Union as well as in Canada, Cuba, Porto Rico and other parts of the world. Hydro-electric and steam power plants, transmission systems, electric railways, large buildings, industrial plants—all fall within the scope of practice of this organization.

An associate says of Mr. Webster: "He thinks quickest and in the biggest figures of any man I know. He is never stampeded, never 'cries over spilled milk,' knows how to make prompt decisions and how to play. His spirit of team play, modesty and a 'bully' sense of humor have won for him the loyalty of his organization and the affection of his associates and co-workers."

Mr. Webster's devotion to his Alma Mater has enriched her counsels and her plant alike. He is a trustee and life member of the corporation of the Massachusetts Institute of Technology. In his life as an engineer and public-spirited man of affairs he typifies the best traits of American business leadership.

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Supply Jobbers Preparing for "Normalcy"

THE electrical supply jobbers naturally are experiencing the same decline in business as the manufacturers. Interchange of stocks, however, has enabled them to clear their shelves and keep down new purchases to a minimum, thus conserving credit. As a class the jobbers have agreed to let liquidation run its course, feeling that the sooner normal conditions are reached the better. The years of the world war were fat ones for the electrical supply jobbers, and were they not now handicapped by war-time organizations and high overhead expense the present would not be a lean year compared with pre-war standards. However, internal organization matters are now in process of adjustment. Jobbers who take a certain pride in their business are anxious that their methods and prices shall conform to normal standards. When, therefore, they are accused of holding up prices they naturally resent it. The manufacturers, they claim, have only reduced the prices of motors and heating appliances 10 per cent, and while the pig-iron base is at present $20 a ton, compared with $50 a ton during the war, rigid conduit has come down only 17 per cent. Manufacturers, however, have in the main written off inventories to present price levels, but with the exception of copper few of these have returned to normal. Certainly manufactured products may be expected to reflect reductions in prices of materials and labor promptly. The enlightened business sense shown by the electrical supply jobbers in the present emergency is worthy of commendation. The war has served to set their business on a firmer foundation, and if we judge the temper of the jobbers aright, they will do nothing to weaken it.

The Public's Interest in Utility Development

WHY should the citizens of the United States, of whom one in eighty is a direct investor in the securities of electric light and power companies and two billion dollars of whose money has gone by way of insurance companies and banks into these same securities, grudge to the companies a reasonable degree of prosperity—that is to say, a fair return under present-day conditions on the actual capital invested and to be invested? This is the question which James A. Perry, president of the National Association of Railway and Utility Commissioners, speaking before the Chicago N. E. L. A. convention, answered when he ascribed public hostility to lack of information. Misled by agitators who, if honest, are equally misinformed with those to whom their appeals are addressed, Mr. Perry finds that many citizens cherish an attitude of unreasoning opposition to the utilities resembling that which confronted the railroads before the war brought the enlightening experiment of government control. "We seldom hear of a municipality," he said, "making an investigation and ascertaining whether there is any merit in the claim of the utility company. Investigations are seldom made, little information is had, and seemingly none is desired." We hope that this attitude is not so widespread as Mr. Perry fears. There are certainly some communities where it does not prevail because the remedy has been applied and the citizens have come to realize that the electric light and power industry is a "wage-earning" and not a "speculative" business and that its wages, which is the true meaning of the return it receives, must be adequate if it is to give those it serves the ever-increasing supply of electrical energy that means so much to domestic comfort, industrial prosperity and community progress. "Audacity, again audacity, always audacity!" was the motto of a famous revolutionist. "Education, again education, always education!" might well be that of our industry.

Sam Robinson Ready to Be Convinced

A DIFFERENT point of view from that of Commissioner Perry, though not a contradictory one, was put before the N. E. L. A. convention last week in racy sentences by Harford Powel, Jr., the editor of *Collier's Weekly*. The two addresses will be found in part elsewhere in this issue and should be read together. Mr. Powel visualized the average citizen in his relation to the electric light and power industry as consumer, taxpayer, voter and investor. He waved out of existence the vague entity known as the public. Customers, he observed, were no more the public than the electric men to whom he was speaking were the public. Instead of a public safeguarding its rights against imaginary rapacious corporations, there is merely a nation of Sam Robinsons, all interested in electricity, all wanting to use it, all resenting company carelessness and condescension. These Robinsonian multitudes are willing to treat fairly those other Sam Robinsons whose business it is to make electricity and sell it, and they will with their billions of savings finance the industry, provided that—and here Mr. Powel's line of thought and Commissioner Perry's converge—the facts are brought home to them. Mr. Powel's argument, then, is one for continuous publicity. True, one form of publicity—the furnishing to newspapers of matter for gratuitous reproduction—may, as the editor-speaker graphically demonstrated, fail in large part unless quality rather than quantity is its distinguishing characteristic. None the less, advertising is indeed industry's breath of life and cannot be suspended or limited to stated seasons without inviting disaster.

N. E. L. A. Prime Movers Report Is a Noteworthy Work

THIS year the report of the N. E. L. A. prime movers committee, abstracted in the issue of June 4, rose to the proportions of a treatise of more than 350 pages. It is full of material of value to the engineer, but the most that we have done or can do is to direct attention to certain parts of it which seem of exceptional value. The chief emphasis must, of course, be laid on the progress in prime movers. There is a tendency toward higher working temperatures and higher speeds, which means working still further toward the limitations imposed by the various materials. How far bearing pressures can be raised without getting into trouble remains to be seen. Until new material for blades has been discovered it is not yet clear what peripheral speed can be endured. Another problem is that with rising temperature there comes increasing difficulty with lubrication.

An interesting development is to be found in the Ljungstrom turbines, in which the steam flows radially outward, expanding between two bladed rotors revolving in opposite directions, and having therefore a relative speed which is double the actual rotative speed. The principle involved has been repeatedly used for various purposes, sometimes without sufficient justification, but in the instance here considered the plan would seem to be amply justified for trial on a considerable scale. Especially is this true since the past few years have shown the great difficulties in properly proportioning and balancing rotors to stand the peripheral speed they have to endure in service, combined with temperatures near the danger point.

It seems to be the feeling of the committee that both higher pressures and higher temperatures are coming. Even now recent plants are working to final temperatures between 600 deg. and 700 deg. Fahr. How much beyond the latter figure one can go without passing the danger point for available materials is not certain, but the limit is sufficiently well in sight to encourage a tendency toward high steam pressure. The present limit of about 350 lb. per square inch is likely to be exceeded before long. In this connection comes an interesting possibility in the way of reheating between stages after the initial temperature has so fallen that the addition will not rise to an inconvenient degree. The principle is well worth trying out, and it is reported that one of the new European plants will be equipped with this in view.

Pulverized fuel has also had considerable attention from the committee. In particular the Milwaukee Electric Railway & Light Company has put in operation a new plant which will have an ultimate capacity of 200,000 kw. The experimental results obtained with this and other plants indicate that the boilers can be pushed to high efficiency and work uniformly and well. Something, of course, depends on the kind of fuel used, with reference to its preparation for burning. It seems to be clear that by the pulverizing process it is possible to deal with widely varying grades of fuel in the same furnace without some of the difficulties commonly found in burning them on ordinary grates. Certain grades of coal now not easily adaptable for firing can be successfully used as powder, and finally there is the additional possibility of working almost interchangeably in the same plant with fuel oil, powdered coal or even gas. As experience is gained with the use of pulverized fuel there is an excellent chance for working in low-grade bituminous coals and lignites on a considerable scale, and the process may prove particularly adapted to so-called mouth-of-mine operation. If the fuel can be pulverized at the breakers, its transportation over moderate distances is a comparatively simple matter involving less handling cost than is required by coal used as fuel in the ordinary way. One of the outstanding difficulties is the unpleasant tendency of ash to go up the stack in rather large quantities. This, however, is a detail which can doubtless be taken care of in due season.

Graphical Solutions for Alternating-Current Problems

THE theory of the general alternating-current transformer, of which the theory of the induction motor is a special case, has been treated for many years on two different lines. Both methods of treatment started with the same premises, using vector diagrams or polar diagrams for the representation of the electromotive forces, fluxes and currents. The analytical method then expresses these diagrams in the form of complex algebra and obtains values for the quantities involved by an evaluation of algebraic equations. The graphical method, starting with the same geometrical diagrams used in the analytical method, attempts to find geometrical loci for the electromotive forces, fluxes and currents, thus making it unnecessary to express in complex algebra the quantities represented in the vector diagrams.

The contributions which Dr. A. S. McAllister has made from time to time to the theory of alternating-current motors have always been marked by a degree of refreshing originality which has aroused interest in them and which has commended them to the attention of the student, the teacher and the engineer. The contribution from his pen published in this issue is no exception to this statement. He deals in a vigorous manner with a problem that many writers in the last twenty-five years have endeavored to solve and yet have failed to solve in so simple a manner as is here done by Dr. McAllister. The principle of the McAllister transformations is by no means new, as it is the transformation by means of inversion or "reciprocal radii" used for many years; but it is most strange that those who have used this method for years have failed to see that it is possible to find for each particular case of the transformation a "center of inversion," from which at a glance the diagram can be transformed into one taking account of such change in the arrangement of the circuits as has to be provided for to cover qualifying assumptions usually neglected in the general theory.

The McAllister transformations supply in a very simple and direct manner solutions for the following problems: (1) What is the effect of primary resistance placed in series with an induction motor, the potential being kept constant at the point where the resistance is connected to the line? (2) What is the effect of primary reactance placed in series with an induction motor, the potential being kept constant at the point where the resistance is connected to the line? (3) What is the effect of primary impedance placed in series with an induction motor, the potential being kept constant at the point where the resistance is connected to the line? (4) What is the effect of a shunt of either resistance, reactance or capacity placed in multiple with the

terminals of an induction motor with additional resistance, reactance or impedance in series with the motor? (5) What are the secondary voltages and secondary currents in a transformer or induction motor under different conditions of load under any or all the conditions mentioned above?

Dr. McAllister's paper appears to us to be a production of exceptional merit, all the more so because of its simplicity and of the fact that electrical literature, rich though it is in publications of a similar character, seems to us to have ignored this solution which is now for the first time presented to the engineers interested in alternating-current phenomena.

Engineering the Basis for Greater Lighting Sales

THE Commercial Section of the N. E. L. A. by no means confines itself to matters of salesmanship. We have learned to expect from it material contributions to the engineering problems daily faced by the central station. The engineering basis of good lighting is the foundation for lighting sales, and the report of the Lighting Sales Bureau at the Chicago convention makes this fact doubly evident. Two lines of advance in particular are marked out in this report, one the directly industrial phase of lighting and the other the lighting of the home. As regards the former matter, evidence is accumulating month by month, and rather rapidly at that, to the effect that improvement in lighting directly and definitely pays in production, not only in the quantity of things manufactured but also in their quality and in the better morale of the workers. Over and over again it has been found that the introduction of a new lighting system has meant definite improvement in output, but the facts have seldom been put more forcibly than in one of the cases cited in this report. An example was taken from a spinning room where the lighting initially was about on the basis which was common among economical engineers twenty years ago, to wit, 1.5 foot-candles. A new system was installed which pushed the intensity up to 9 foot-candles, and the immediate result was an increase of output of 18 per cent. The speed of the machines was not, and could not be, increased, so that this gain simply represented the added efficiency of the operator in rapid work when hand operations were required on the machine. This experience not only bears out the general principle of improved output but also shows directly that the effect was due to the improved time element in working produced by higher illumination. It is one thing to see the detail in a machine which requires attention; it is quite another to see it well enough and quickly enough to put things to rights in the shortest possible time. It is only recently that this time element of vision has been given attention, and the more it is studied the more plainly it will be demonstrated that illumination just sufficient for vision without eye strain is a very different thing from the illumination which produces that facile vision which tends to efficiency.

The second matter, that of house lighting, is treated briefly but in an exceptionally effective way by actually showing the methods to be adopted, the fixtures to be used and the outlets to be provided in a typical small house. There was a time in the fortunately distant past when it was the practice of many central-station operators to look on residence lighting with contempt and to read papers proving that it never had paid and never could pay except at enormously increased prices. That idea has subsided under the pressure of facts, and its exponents do not attempt any further propaganda, realizing that if residence lighting appears not to pay, it is simply because it is mishandled. The special feature of the typical lighting layout recommended by the committee is the large number of convenience outlets for use with appliances or extra lamps. Their number is almost a third of the total, and experience today indicates that such a proportion is not in the least overdoing the matter. An outlet of this sort may be unused for several years, but some day it is wanted and wanted badly. If not provided at the start, it is a troublesome and expensive matter to supply the need later.

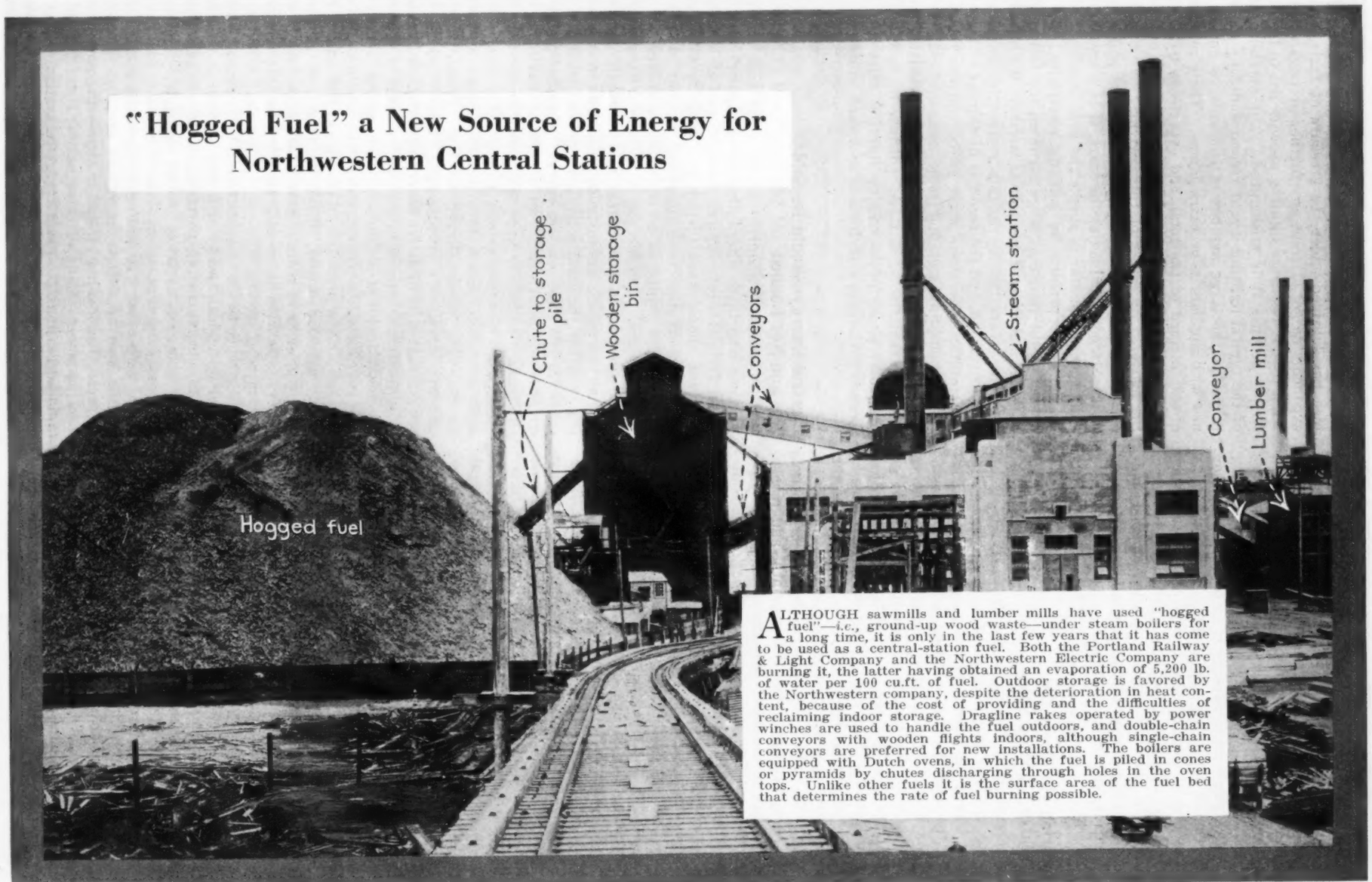
The great problem of putting electricity into the houses of the people at large turns on the introduction of easier and cheaper methods of wiring. We have been for some years tied up in this respect by propaganda and convention, and the result is disastrous in the older communities where one must go beyond the limits set by new building and find some means of wiring the dwellings already in existence at a reasonable price. We hope that the N. E. L. A. will take up actively this particular phase of increasing lighting sales and find means of relieving a trying and awkward situation.

Electric Energy Should Be Sold and Not Loaned

IT IS generally admitted on all sides that any customer who takes alternating-current power at a low power factor thereby injures the service of all his neighbors and should have to pay at a definite extra rate. Various plans have been suggested, or may already be in operation, aiming at an equitable surcharge for low power factors. One method is to have a basic rate on active energy and a surcharge rate on reactive energy, so that two meters are installed on the customer's premises, one for the total active energy consumed and the other for the total reactive energy. Another plan is to measure the power factor at a time of maximum load and make a surcharge upon this power factor if it falls below a certain percentage value. This week M. L. Sindeband describes a rate schedule based upon, say 85 per cent power factor as the normal. If the customer develops a lower average than this, the rate per kilowatt-hour of active energy consumed is increased in approximate inverse proportion, whereas if the average power factor of his installation increases, his energy rate is reduced. Moreover, automatic cut-out relays are installed on the premises, to disconnect the service if a steady overload occurs, either by reason of increased consumption or of reduced power factor, so that the customer's attention is speedily directed by this means to the source of trouble.

The proper business of an electric service company is to sell electrical energy and not to loan it. Lamps, heaters, etc., operating normally at 100 per cent power factor consume electrical energy outright. However, all motors require to be magnetized as well as to be fed with energy, and alternating magnetization calls for the loan of electric energy at each alternation of current. The loaning of energy represents power—*i.e.*, reactive power—being directed outward and inward in rapid succession. No electric service system should be expected to loan energy without charging for it, because the loaning business is a drain upon the conductors, the transformers, the generators and all the system.

"Hogged Fuel" a New Source of Energy for Northwestern Central Stations



ALTHOUGH sawmills and lumber mills have used "hogged fuel"—i.e., ground-up wood waste—under steam boilers for a long time, it is only in the last few years that it has come to be used as a central-station fuel. Both the Portland Railway & Light Company and the Northwestern Electric Company are burning it, the latter having obtained an evaporation of 5,200 lb. of water per 100 cu.ft. of fuel. Outdoor storage is favored by the Northwestern company, despite the deterioration in heat content, because of the cost of providing and the difficulties of reclaiming indoor storage. Dragline rakes operated by power winches are used to handle the fuel outdoors, and double-chain conveyors with wooden flights indoors, although single-chain conveyors are preferred for new installations. The boilers are equipped with Dutch ovens, in which the fuel is piled in cones or pyramids by chutes discharging through holes in the oven tops. Unlike other fuels it is the surface area of the fuel bed that determines the rate of fuel burning possible.

The Public Viewpoint

An Analysis of the Average Man's Conception of the Electric Light and Power Industry, in Which He Is Interested Because He Is a Consumer, a Taxpayer, a Voter and an Investor

By HARFORD POWEL, Jr.
*Editor "Collier's Weekly"**

YOU are getting strongly interested in what people read. You want them to read your story. You want them to connect their houses with your factories. You want them to flood their houses with light. You want your average customer, Sam Robinson, to use all the various devices and appliances that make life easier and less laborious, that do for Mrs. Robinson today what it took a small army of servants to help her do in the past.

Well, gentlemen, yours is not a hard service to sell. But you want people to go farther still; you want them to support your industry with their investments. You want them to study the facts before they pay attention to the ill feeling that now and then springs up—not against you alone, but against every man and group of men who supply some service or commodity for money. So you are interested in what people read. You are beginning to speak to them through the printing press. You are not so silent as you were a few years ago.

You believe that the public should have the facts, and you believe that when the facts are before them you will receive in every city and village in America the squarest kind of a square deal.

And you will receive it. You will have more demands for your service. You now supply with electricity six million and a half of the twenty-one million homes in America. That's a fair beginning. Nobody in his senses thinks that is more than a beginning.

Fourteen Million Houses to Supply

You have more than fourteen million houses to supply —houses now standing. And before you finish that little job, there will be built a million and a half new homes to take care of the housing shortage, five thousand new schools, sixty thousand new apartment houses, fifteen thousand new theaters. But never mind the future. Right now there are five million unwired houses within reach of existing electrical supply stations. You have got about half way through your job of supplying light to the householders; and now you expect to finish the job.

To do it, gentlemen, every one knows you need money.

You need it in such large amounts that you are out of the class of the average business man who can borrow it from a banker or group of bankers.

You have to go direct to the only bottomless well of money that exists in the world—the little pools of people's savings—those little pools, million after million, through which trickles all the wealth there is in America. For that's where the big money is. It is the only place where it is. You won't get the four billion dollars you propose to spend before 1925 out of the vaults of banks and insurance companies alone. You must look for it in the family sock. You must coax it out of grandmother's purse. You must show the workingman cause when you ask him to take it out of his pay envelope and lend it to you. The four billion you need for expansion is partly in the merchant's cash drawer, partly in what mother has saved out of her housekeeping money, partly in what Sam Robinson and Pat Murphy and Ole Johnson have laid by for a rainy day.

That's what you are talking about the minute you start talking about billions of dollars. And there's no half-way measures about it. Either you'll get that necessary money or you won't get it. Either you'll move forward or you'll slip back—for in no business is there such a thing as standing still.

Advertising Must Be Continuous

Every one who reads newspapers and magazines knows that you are doing far more advertising than you have done and are making a serious and intelligent bid for public interest and public good will. It is not wise to think of that, or to speak of it, as an advertising campaign. There is no such thing. You can accomplish anything by advertising. You can accomplish nothing by an advertising campaign.

Either you advertise or you don't advertise. The word "campaign" is too limited to describe this thing. You might as well speak of a "breathing campaign" or an "eating campaign." You can stop breathing and let your lungs rest—but more of you will soon be at rest than your lungs.

Do not think of advertising as something to be done by fits and starts. Don't think that a campaign started and finished this year will produce a finished and final effect. If you have any such idea, take twenty deep breaths right now and then try to stop breathing till lunchtime. Some old minister went to Billy Sunday and day and said, "You're a fake. You get people all stirred up. They hit the trail. But your conversions don't last." "Well," said Sunday, "neither does a bath."

You are making conversions by your scraping our chins every morning and expect them to last. We have all been scraping our chins every morning for years—but the effect does not last. Advertising is like that. It is a matter of repetition. Of convincing a man once and convincing him again. Say it. Repeat it. Then repeat it again. The human mind wabbles. Keep it wabbling your way.

This has nothing to do with the amount of money you spend. It depends entirely on how you lay that money out. You have a great story to tell—the finest, I think, in the world. You have a great service to sell. You have a chance to make America happier, better educated, better knit together. The one great circuit you propose to build will have a lot to do with breaking down arbitrary lines of feeling between districts, states and cities. You are expanding the city limits every-

*Paper read before the National Electric Light Association Convention, held in Chicago last week.

where, so that the farmer feels he is part of the community and not merely a sort of Robinson Crusoe on an island cut off from civilization.

Of your advantages, every man in the room is better qualified to speak than I. People are well disposed to you. They are alive to the fact that after long silence you have at last started to speak to them. They know they need your service. Sam Robinson knows he needs it. People in his town who haven't got electric light envy Sam because he has got it. Your salesmanship this year will fall upon as fertile soil as ever it has fallen in the past.

You have not suffered from the ills that have recently beset most industries; you have few bad debts to write off and few inventories to write down; your business as manufacturers of electricity has not greatly decreased in volume, and you are now getting the benefit of declining costs.

Are there any handicaps at all in your way?

INDIFFERENCE LOSES CUSTOMERS

You supply a great service and you know it. Be reluctant to feel that you are doing a customer a favor by supplying him with light or power. He is doing you just as big a favor by allowing you to supply him. He resents even a trace of indifference or of arrogance. Public utilities lose very few customers when they put their rates up. They lose many customers whenever they fail to furnish service and courtesy.

Your customer's income may be small. He may be shabby. He may be tired, cross, unreasonable. But he resents any coldness or carelessness on your part, just as you resent it from any merchant with whom you deal. You're a mighty industry, getting bigger and more prosperous all the time. He's just little Sam Robinson. But he's the fellow who in the long run breaks any industry, any government or any religion.

Don't think of Sam Robinson as "the public." You are just as much "the public" as he is. If we could get those two vague words "the public" out of our systems, we'd all take a giant step forward on the road to law and order and peace and prosperity.

INDIVIDUAL COUNTS MOST

It's the little things that look largest to the individual. It's the individual who in the long run looms largest with you. Study Sam Robinson—don't worry about the public. Serve Sam Robinson—the public can take care of itself. Watch out for Sam Robinson when he first comes to see you. First impressions count. Have you enough help in your office so that Sam doesn't have to wait. He likes to wait just as much as you do.

It was Marshall Field who first impressed on his people this slogan, "The customer is always right." No store of that grade, big or little, will let even one customer get away unsatisfied. If she's honestly disappointed, she always gets her own way, even though she carries her complaint to the proprietor of the store. Sentimentality? Blarney? Waste of time? No. Simply common sense. For one injured man or woman, with a free swinging tongue, can hurt you more than a hundred satisfied customers may help.

Where do the agitations for lower rates—rates that are unfair to you and your employees and your bondholders—come from? Do they come from people who have analyzed their bills, and studied your annual statements, and inspected your methods of operation? Not a bit of it. Agitations are sometimes led by professional experts in that line, but the rank and file are people who want a chance to show some big corporation where it gets off and that they are as good as it is. We can forestall that feeling by making people realize that we know they are as good as we are. In our contact with them, we can avoid two deadly sins. One is carelessness. The other is condescension.

I don't know whether your scientists—and you have the best brains of American engineering among them—are at work on improving the meters you use. They are instruments of precision. They measure current to a hair. If they make any mistakes at all, it is in favor of the customer. Sam Robinson has an idea you could still improve this instrument.

I think that eventually—very gradually of course—those 1898 meters can be withdrawn from 1921 homes, and that the great electric supply houses will co-operate with you in making and installing something that will give the public more confidence in themselves and in you—something that will measure your "juice" just as openly and clearly in dollars and cents as the taximeter measures transportation or the cash register accounts for cash. Old stuff, I know.

USE OF PUBLICITY MATTER

What I have here is an awful example of publicity gone wrong. This scrap basket was loaned to me by one of Chicago's evening newspapers It contains the daily grist of "publicity matter" that comes to that one paper. Those sheets, gentlemen, are the earnest work of press agents from coast to coast. Do you suppose the writers know how much of it there is? Today is Thursday. There was just as much yesterday. There will be just as much tomorrow. And every paper in Chicago—every paper in America—gets it every day. It's a full day's work for one man to read it through from end to end. This press material on the floor—all cheerfully labeled "for release June 1"—aggregates just over a thousand columns, or enough to fill solid all the four papers in this city tonight.

The time has come to give the newspapers only what they can use. What they want, of course, is news—and news that will interest as many people and as many different kinds of people as possible. They like variety, they like to get news the other papers have not been able to get. But I am not going to venture on any analysis of publicity of this kind.

Let me tell you why Sam Robinson is really interested in you. Let me tell you why he'll read your advertising and actually search the newspapers for news about you. Let me tell you why Sam thinks about you more than he thinks about other manufacturers. It's because Sam is interested in you in four ways:

He's interested in you as a consumer.

He's interested in you as a taxpayer.

He's interested in you as a voter.

He's interested in you as an investor.

There are the four ways Sam Robinson looks at you. There are your four roads to his heart. And let me tell you this, and I tell it to the everlasting honor of the American people—when Sam makes up his mind that a man is square and right, that a business is square and right—why, then Sam sticks with it through thick and through thin.

Treat Sam Robinson fairly, gentlemen, and he'll play fair forevermore with you. You know whom I've been referring to as Sam Robinson, of course. Lots of people call him Uncle Sam.

Substations for 110-Kv. Transmission Lines in France

Energy Delivered from Hydro-Electric Station in Switzerland Is Made Available for French Industry —Substation Apparatus Partly Out of Doors

BY M. A. HENRIOD
Electrical Engineer, Paris, France

THE principal features of the transmission-line design and construction adopted for the transfer of hydro-electric energy at 110 kv. from Goesgen, Switzerland, to substations at Delle and Pouxeux were discussed in the ELECTRICAL WORLD for April 30 in considerable detail. The discussion is completed in this issue by a brief treatment of these two principal substations on French soil.

Switch Racks.—In order to make inspection easy and to permit quick location of troubles, switch racks have been erected at Bavilliers, Plancher les Mines, Severance and Rupt, dividing the line in sections of about 13 miles (21 km.). These switch racks are provided with three aërial disconnecting switches which can be operated from a walking platform. Close to each switch rack a little house for the watchman and material storage was built.

Pouxeux Station.—At Pouxeux the line is connected to an electrolytic lightning arrester mounted out of doors, as shown herewith. Then the line enters the substation of the Compagnie Lorraine d'Electricité and is connected to the buses through a choke coil and a circuit breaker with remote control. Potential and current transformers are supplied for the control circuit and measuring apparatus.

Delle Station.—This station is the terminus of the line coming from Goesgen and is the connecting point between the Swiss line to the French line. The building was erected 1,600 ft. (490 m.) from the border and is so arranged as to permit an extension in the future. It is equipped with 110,000-volt devices, which allow the power stations of Goesgen and Vincey (the steam power station of the Compagnie Lorraine) to be run in parallel. It is also equipped to cut the circuit under load and to record the passing energy.

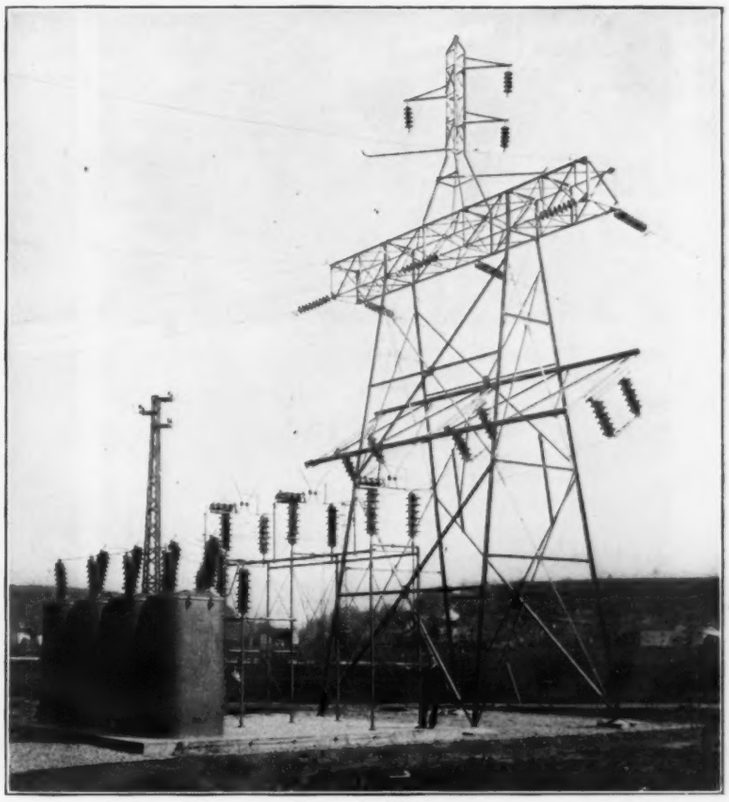
Before entering the station the lines are protected with choke-coils and have three horn-gap lightning arresters. A 10,000-ohm resistor made up of cylinders of "Koppat" is connected in series on the last string of insulators and used as a "bumper." All these devices are mounted out of doors on a steel structure which is the dead-end of the line. The conductors enter the station through special bushings secured at the center of a glass plate 5 ft. (1.5 m.) square and protected by a reinforced-concrete shed.

The top floor is reserved for the choke coils, disconnecting switches and the fuses of the measuring transformers and does not have any apparatus involving oil. The grounding resistors (Brown-Boveri), which are also used as potential transformers, are installed on the main floor with the current transformers and circuit breakers.

The connections in copper tubing are carried, as are the disconnecting switches and fuses, on insulating columns of "Bituba" 3 ft. (1 m.) high. No walls have been provided between phases, but precautions have been taken for fire protection. The circuit breakers are in closed rooms which the wires enter through wall bushings. Furthermore, under each apparatus in an oil bath a drain is provided.

The closing of the circuit breakers is operated by a direct-current motor. The tripping is operated by relays directly connected on the high-tension side, but the mechanism can be operated by hand in case of emergency. The control circuit is provided with lead-covered cables laid in the floor and connected to the main board carrying switches, operating devices, measuring and synchronizing apparatus. A similar arrangement is provided for the auxiliary service with the switchboard in a room directly beside the operator's apartment. There is a small storage battery with its charging devices on the second floor.

A private telephone line connects the Delle substation with the Pouxeux substation and touches each switch rack. The telephone communications with Goesgen in Switzerland are made in Delle by the government telephone administration.



ELECTROLYTIC LIGHTNING ARRESTER INSTALLED OUT OF DOORS

It should be mentioned also that the parallel operation of the power station of Vincey with the hydro-electric power station of Goesgen causes no difficulty at all, although these power stations are 140 miles (225 km.) apart.

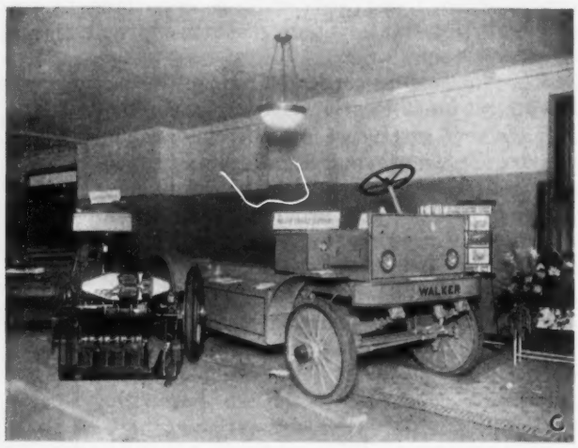
As the transmission line route on French territory passed through the war area, the design was made in accordance with the orders of the War Office, which offered the help of the military personnel in the work of erection. The Swiss section was built by the Société Motor, helped by the water-power department of the French War Office in obtaining the material.

Chicago Holds Successful Vehicle Show

At the Electric Shop of the Commonwealth Edison Company last week the public as well as the executives attending the N. E. L. A. convention had an opportunity to see the progress that has been made in battery transportation. In A are shown charging panels; batteries and road trucks in B and C; pleasure cars in D; industrial tractors in E, and accessories in F and G.

A

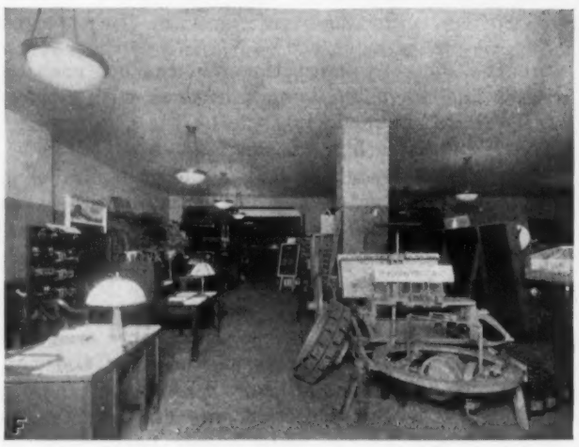
B



C

D

E


F

G

New Era Dawns for Electric Vehicle

Appreciation of Service Achievements and Possibilities Reflected in National Thought and Action—Leaders of the Industry Indorse Economic Battery Transportation

A NEW day has dawned for the electric vehicle after a period of sub-normal appreciation of its economic capabilities. Lukewarm interest and indifference have been challenged by progress. Faith in the superiority of battery transportation within its proper field and perseverance in demonstrating the inability of gasoline and animal transportation to dominate short-haul urban service have been rewarded. The line of new installations is rapidly lengthening, and many of the foremost men in the industry are standing up to be counted as believers in the electric vehicle opportunity. Actual service achievements are convincing the business world that electric road and industrial trucks and passenger cars must be reckoned with as tried and successful transportation agencies within a broad and profitable field of usefulness. Manufacturers are keenly alive to service needs, and central-station companies are awakening to the extraordinary value of the battery-charging load.

NEW ENTHUSIASM AROUSED

At the Chicago convention of the National Electric Light Association last week the electric vehicle went "over the top" and carried the first-line trenches of that ever-present enemy of progress—uninformed indifference. Men like Samuel Insull, John F. Gilchrist, Milan R. Bump, E. W. Lloyd, Joseph B. McCall, W. H. Atkins, Arthur Williams, W. W. Freeman, John W. Lieb, F. W. Smith, W. H. Blood, James H. McGraw and E. S. Mansfield do not align themselves with losing causes or champion hopeless ventures. These and three hundred other supporters of electric transportation were in the front line of attack in what was well declared "the greatest electric vehicle meeting in history," and the impetus given at Chicago to electric vehicle progress through the convention, the fine show at the Electric Shop of the Commonwealth Edison Company and the working exhibit of service trucks and cars on the streets and in the industrial plants of the city will not soon subside.

Henceforth the advance of the electric vehicle is to be based upon a higher grade of application engineering than has often been displayed in the past. By the intelligent selection of improved equipment better installations will be made. The "electric" of today, as Arthur Williams pointed out in his able paper before the Commercial Section at Chicago, is not the car of ten or twenty years ago. In every feature of construction and equipment, from battery to motor through to each part, including steering gear and frame, there have been many decided improvements. The manufacturers are becoming increasingly united for far-sighted, co-ordinated field work. They are undertaking a careful study of transportation conditions, and it is desirable that central station and industrial engineers work with them. As a part of this effort they are planning to sell their product on a scientific basis, and a committee was recently appointed, having a membership of some of the ablest men connected with the industry, to prepare an electric vehicle sales manual. In this will be pointed out the best field of application and the best selling arguments. Other questions looking to a larger public development will also be considered.

The Chicago show, which extended from May 26 to June 4, was the first purely electric-vehicle display ever held in that city. Thirty-one exhibitors occupied about one-sixth of an acre set apart in the great Electric Shop of the Commonwealth Edison Company, and not a few others sought space too late. Road trucks, pleasure cars, charging apparatus, batteries, motors, industrial trucks, tractors, trailers and accessories were advantageously displayed under the direction of L. T. Carpenter of the Commonwealth company. As a result of the shows held in New York, Chicago, and Newark, N. J., fifteen or more shows are likely to be held next year.

A significant movement is in progress at Chicago under the auspices of the Board of Education's public continuation school to provide training in the fundamental principles and practical operation of storage batteries and electric vehicles. The course consists of sixteen lessons given by R. Macrae, electric vehicle engineer of the Commonwealth company, two three-hour sessions a week being held.

EDISON'S MESSAGE OF OPTIMISM

One of the features of the N. E. L. A. convention was the reading by Samuel Insull at the electric vehicle meeting referred to of a letter by Mr. Edison which said: "I am pleased to hear that the electric vehicle for city traffic is receiving more attention lately from the electric lighting companies. Any merchant who keeps accurate costs will buy electrics." This latest indorsement by the great inventor, who has long been interested in the advance of this branch of the industry, was welcomed as an expression of encouragement and opportunity.

More than 4,000 electric vehicles are now in service in Chicago, 90 per cent of the trucks being on Commonwealth Edison lines and yielding a revenue of above $400,000 a year to this central-station company. The American Railway Express Company now operates 1,284 electric trucks, representing 52 per cent of the fleet owned by this organization. More than 50 per cent of the electric trucks in the United States are operating in the New York district, and the sales of electric trucks in New York in 1920 represent a 300 per cent increase over 1919. In the last six months of 1920 Chicago sales of electric road trucks increased 15 per cent and of industrials 25 per cent. It is estimated that electric vehicles now in service consume 200,000,000 kw.-hr. annually, representing, at 5 cents per kilowatt-hour, $10,000,000.

Figures like the above emphasize the economy and reliability the service electric vehicles are yielding. It is interesting to note that electric equipments are

long-lived under reasonable care. Not long ago, says Arthur Williams, a maker of gasoline trucks advertised very extensively that forty-eight of his first fifty vehicles were still in service after eight years. Such a record is one to boast of in considering the life of a gasoline truck, but it is young indeed in comparison with the vital statistics of "electrics." On Jan. 1, 1921, of the 4,362 electric trucks used in New York City one year or more the age classification was:

Number	Age in Years, Each	Number	Age in Years, Each
5	23	221	12
7	20	980	10
25	18	1,580	8
33	17	2,448	6
106	15	2,899	5

In the electric vehicle the central-station company has an opportunity for the development of an exceedingly profitable business. No additional investment to handle 75 to 90 per cent of this service is required in generating equipment, transmission lines, feeders or secondary distribution apparatus. The greater portion of the energy sold for electric vehicle operation is produced off-peak. As garages for this class of service are usually near the business district, existing distributing systems are generally adequate.

DOES WORK AT LESS COST PER UNIT

F. J. Bridges of the Hydrox Company, Chicago, said recently that his experience showed the electric vehicle to be the best transportation agency for 30-mile to 35-mile service, operating costs being as low as by horses and the service better. The congressional commission report on mail handling declared in February, 1921 (Senate Document 416), that the use of electric trucks in New York will save annually over $200,000. A comparable service test by the Westcott Express Company, New York, under the direction of C. C. Lambert, general manager, showed that a 3-ton electric truck eight and one-half years old handled 3,294 pieces of baggage at an operating cost of $107.88, while a 3.5-ton gasoline truck six and one-half years old handled 3,296 pieces at a cost of $226.57. Drivers' wages were not included, as these would have been practically the same in each case; and depreciation, which would have been lower with the electric, was also omitted.

John W. Lieb, vice-president New York Edison Company, pointed out not long since that the electric vehicle should function effectively in reducing the wide gap now existing between the cost of wholesale production in the factory and the retail selling price. Business has effected improvements lately in internal transportation but is far behind on external delivery economies. The cost of delivery from trunk-line terminals to the consumer is generally a much greater expense than the whole freight cost from the factory to the trunk-line terminal. Vast improvements can be made in city haulage. Duplication of routes can be avoided and better schedules worked out in which the electric truck should play an important part. John F. Gilchrist of the Commonwealth Edison Company, Chicago, is another believer in the economic value of the electric vehicle within its field of useful service.

BRIGHTER SKIES AHEAD

E. S. Mansfield of the Boston Edison company, chairman of the Electric Vehicle Bureau of the N. E. L. A. and long a hard worker in the cause of transportation by vehicles charged with central-station energy, stated to an ELECTRICAL WORLD representative that the outlook is excellent today for a sane and consistent development. In the past there has been a tendency to expand the use of both passenger and commercial electrics into fields and to an extent for which they were not designed or are not adapted. Many of the apparent failures are due to this cause. The "electric" has a limited sphere of action and should be confined to its own field, he said, but within this field its usefulness is practically unlimited and the possibilities are great.

Mr. Mansfield believes that a closer working understanding between the manufacturers and the central-station companies must be accomplished. The manufacturer must realize that the central-station companies' transportation service requirements are not fundamentally electric, and he should not try to force electric vehicles upon them. The manufacturer has a right to expect, however, that the central-station company will assist in selling electric transportation to such of its customers as can benefit thereby. In time the experience of such customers will in turn tend to create in the central-station company a desire to use "electrics" in the latter's transportation system under favorable conditions.

"Every central-station company," said Mr. Mansfield, "should have some one in its organization sufficiently informed in electric transportation to be able to advise its customers impartially on such questions as they arise. The manufacturers' agents, on the other hand, should work in sympathy with the utility power salesman for the building up of the power load. Garages and service stations should be established in all centers where individual installations may be cared for until plants of sufficient size have been secured to permit of the establishment of private garages. The garage and rate committee of the bureau has plans under way to provide building plans, details and costs of equipment and operation, rates and revenue to be obtained, based on actual experience for a model garage, so that a central-station company, manufacturer or private investor may know in advance the probable result of such an investment.

TO HAVE MORE EXHIBITS

"Electric vehicle exhibits are of great value in stimulating interest among ourselves and, by educating the public, in creating a larger market for the electric. A committee has been appointed and is actively at work in an attempt to increase the number of electric vehicle shows, several of which have already been held with marked success.

"One of our greatest needs is impartial, reliable data based on actual experience of the advantages and financial profit enjoyed by those who are operating 'electrics' in their transportation system, and a comparative data committee is already at work gathering together such information in a manner and to an extent which will be of tremendous advantage to the business. Other suggestions might be added, but if those already touched upon could be realized within the coming year, others would be brought forward as a natural development.

"Energy, co-operation and a courage born of conviction are most needed, and if instead of looking backward over the failures of the past we shall awaken to the opportunities which the future holds in store, those who have cast their lot with the transportation side of the great electrical industry will realize that they have not labored in vain."

Graphical Calculation of Interconnected A. C. Circuits

By Combining Two Well-Known Methods in a New Way an Accurate Graphical Solution Is Developed for Problems Relating to Interconnected Circuits — Applications Are Made to the Conventional Equivalent Circuits of Polyphase and Single-Phase Induction Motors

By A. S. McALLISTER
Consulting Engineer, New York City

ON ACCOUNT of the very large number of articles, papers and books that in recent years have been written relating thereto, it is safe to assume that methods of constructing graphically the exact current locus of interconnected circuits such as those usually assigned to the induction motor have been of widespread interest. In view of the very numerous partial solutions of the complete problem and complete solutions of parts of the problem, it is believed that a simple solution of this and allied problems relating to interconnected alternating-current circuits, complete in every detail, without involving any approximation, will be welcome at this time.

The solution described herewith, although a self-evident one, seemingly has not previously been developed in spite of the fact that many authors, including the present writer, have frequently utilized all of the fundamental relations essential to its development. In fact, a careful examination of the entire available French, German and English literature seems not to reveal an anticipation of the method about to be described.

Use is made of the "reciprocal-vector" method of transforming from one assumed constant condition in electric circuits to another assumed constant condition—a method similar to the one utilized by both Bedell and Behrend more than twenty-five years ago. Use is also made in each case of the "electric circuit" method of representing alternating-current relations, and for the purpose of giving emphasis to the most familiar case, the "equivalent electric circuits" chosen as the initial example are those of the polyphase induction motor treated as the general alternating-current transformer, such as are employed by Steinmetz in his first book on "Alternating-Current Phenomena." In combining these two familiar methods, the transformation by the "reciprocal vectors" is made, not in the more usual way from an assumed constant current to actual constant voltage, but by determining what would be the primary current and what would be the total primary impressed voltage required if constant voltage were impressed initially across merely the "shunted portions" of the "equivalent electric circuits" and finally across all of the circuits as in actual practice. In this way there are determined initially two separate circular loci, one representing voltage and the other current. The arbitrary voltage and current scales are selected in such relation to each other that the two circles, as plotted, have equal diameters, and on this account the two final "reduced circles" of voltage and current, obtained as a result of the "reciprocal vector" transformation, are of equal diameter. Moreover, that circle which represents the primary current becomes identical with the circle representing simultaneously the voltage consumed in the primary impedance and the delivered secondary voltage when a proper shift is made in the origin or co-ordinates of the voltage and current vectors.

In order first definitely to establish the accuracy of the method employed and to permit one most readily to follow each step in the development, there will be shown both the initial primary current locus and the initial primary voltage locus derived therefrom, together with the corresponding "reduced" separate loci of the primary current and secondary voltage. There will then be developed the equally accurate (absolutely exact) combined primary-impedance-voltage, secondary-circuit-voltage and primary-current circular locus, which is drawn immediately from the known "constants" of the motor without necessitating the introduction of the intermediate steps initially established.

Application to the Polyphase Induction Motor

Referring now to Fig. 1, there are presented the well-known "equivalent electric circuits" of the polyphase induction motor, which are here accepted as representing correctly the interrelations of the several "constants" of the machine—the "constants" being treated as absolutely constant, as is always done with both graphical and analytical methods. It must be understood that in actual operation the "constants" of the motor vary somewhat. However, the method here described gives absolutely exact results for the "constants" assumed, and these results do not depart appreciably from practical accuracy by reason of the variation in the "constants."

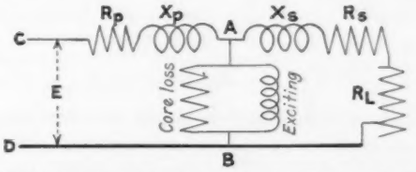


FIG. 1 — EQUIVALENT ELECTRIC CIRCUITS FOR THE INDUCTION MOTOR UPON WHICH SOLUTIONS IN FIGS. 2 TO 6 ARE BASED

The voltage is assumed constant across the shunted circuits (at *A B*), resulting in the two large circular loci of the primary voltage and primary current. Finally the voltage is treated as constant across the primary (at *C D*), resulting in the reciprocal circular locus of the voltage across *A B* and the reduced circular locus of the primary current.

Briefly stated, the problem of determining the exact locus of the primary current vector with constant emf. impressed between *C* and *D* is solved immediately by ascertaining the locus of the voltage consumed in the primary impedance between points *A* and *C*. This voltage becomes at once the primary current locus by

reason of the fact that the ratio between the scales for plotting voltages and currents has been set to equal the primary impedance, and a shift equal to the "primary impedance angle" has been made between the vectors of reference for the time-phase angles of the voltage locus and the current locus respectively.

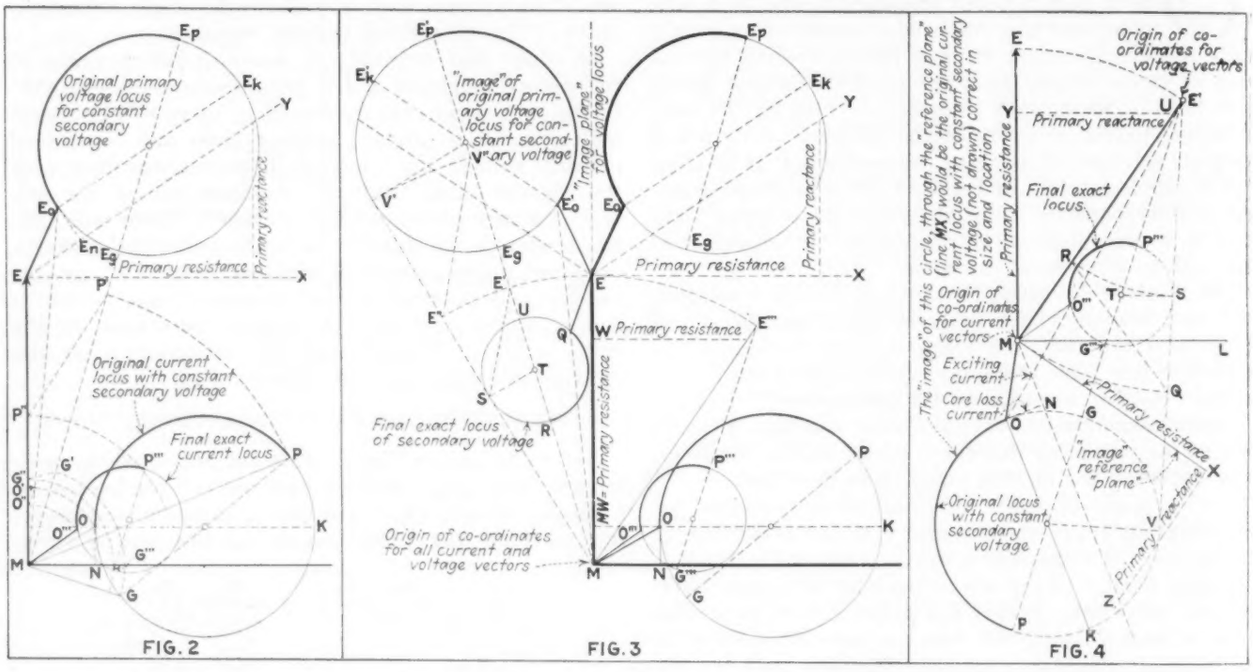
In the same manner and simultaneously, the exact locus of the "shunted-circuit" current (combined core loss and exciting current) is determined from the locus of the vector representing the voltage between the points *A* and *B*, which voltage locus becomes at once the "shunted-current" locus, when plotted to the "shunted-circuit-impedance scale" and shifted by the "shunted-circuit-impedance angle." The vector difference between the primary current and the "shunted-circuit" current is the secondary current of the machine—reduced to primary terms and plotted to the proper scale.

For the purpose of establishing the combined locus of the primary impedance voltage, secondary circuit voltage and primary current, there are located first the combined secondary and "shunted-circuit" current locus when the voltage impressed between points *A* and *B* (Fig. 1) is held constant and the simultaneous locus of the voltage between *C* and *D* in order to hold the voltage between *A* and *B* at a constant value under the conditions assumed.

In Fig. 2 *MN* represents the constant "exciting current," *NO* the constant "core-loss current," and the circle *OPK* is the locus of the extremity of the vector (measured from *M*) representing the combined exciting, core-loss and load currents. The assumed constant voltage across *AB* is the vector *ME* plotted vertically to the "ampere scale," with a value equal (in amperes) to $E \div Z_p$ where *E* is the constant emf. (in volts) and Z_p is the primary circuit impedance (in ohms).

The angle *YEX* being plotted equal to the "primary impedance angle," and the circle $E_oE_pE_k$ being drawn as an exact duplicate of circle *OPK*, it becomes at once the locus of the extremity of the vector (measured from point *E*) representing the voltage consumed in the primary impedance (between points *A* and *C* of Fig. 1) when the voltage is held constant across *AB*. It will be appreciated that the vectors to the voltage circle of Fig. 2, when measured from point *M*, represent the emf. that must be impressed between *C* and *D* (in Fig. 1) in order to hold the voltage constant across *AB*.

By the "point-by-point" method one can readily determine from Fig. 2 the locus of the primary current when the emf. across *CD* (of Fig. 1) rather than that across *AB* is kept constant. For any chosen current point (such as *O*, at "synchronous no-load") the primary current vector has the value and time-phase position *MO* (of Fig. 2) when the impressed voltage has the value and time-phase position ME_o. When the impressed voltage is changed in value and time-phase position with reference to *ME*, the "synchronous no-load current" assumes a new value *MO'''* such that the angle *OMO'''* is equal to the angle E_oME, and $MO'''/MO = ME/ME_o$. The method of locating the point *O'''* graphically is self-evident. In exactly the same manner are located the "reduced-current" points *G'''* and *P'''* corresponding to the original current points *G* and *P*. The "reduced-current" locus passes through the three points *G'''*, *O'''* and *P'''* and being a circle (as will be shown later) can now be drawn at once in its entirety.


Original primary voltage locus for constant secondary voltage
Primary resistance
Primary reactance
Original current locus with constant secondary voltage
Final exact current locus
"Image" of original primary voltage locus for constant secondary voltage
"Image plane" for voltage locus
Final exact locus of secondary voltage
Origin of co-ordinates for all current and voltage vectors
Origin of co-ordinates for voltage vectors
Final exact locus
Origin of co-ordinates for current vectors
Exciting current
Core loss current
"Image" reference "plane"
Original locus with constant secondary voltage
The "image" of this circle, through the "reference plane" (line MX) would be the original current locus with constant secondary voltage (not drawn) correct in size and location
FIG. 2
FIG. 3
FIG. 4

FIGS. 2, 3 AND 4—METHODS FOR DETERMINING THE EXACT CURRENT AND VOLTAGE LOCI FOR THE POLYPHASE INDUCTION MOTOR

Fig. 2—Point-by-point method of determining the final "reduced-current locus" from the proportionality of the secondary to the primary voltage vectors with proper (identical) shift in phase. Fig. 3—Reciprocal vector method of determining the locus of the secondary voltage, which becomes the final exact current locus when shifted through the proper time-phase angle and given a new origin of co-ordinates. Fig. 4—Short-cut method of determining the exact circular current locus and simultaneously the primary and secondary voltage locus, all facts being fully accounted for.

The Unique Undistorted Diameters.—It will be noted that the points *P* and *G* have been so selected that the corresponding points E_p and E_g in the "primary impedance voltage circle" lie on a diameter which when extended passes through the point *M*, the origin of co-ordinates of the voltage vectors. The points *P* and *G* are, therefore, diametrically opposite in the original

current circle. Moreover, the points P''' and G''' in the "reduced-current circle" *lie on a diameter*, so that the last-named circle is fully located when these two points have been determined, since its center lies midway between them.

As will be appreciated fully from a study of the illustrations presented, the diameter selected is unique in that it is the only diameter of the original circle connecting points which when "carried over" to the "reduced-current" circle remain on a diameter. As compared in location with the "unique diameter" of the original circle, the "unique diameter" of the "reduced-current" circle is in general displaced by a certain angle (shown in Fig. 2 by the angle between P''', G''' and PG), which varies through a wide range and may be zero (for zero core loss and zero primary resistance) or even become negative—with zero primary resistance but normal values for all other circuit constants.

Method for Finding Reduced Voltage Locus

Referring now to Fig. 3, the original current locus and the original primary voltage locus have been plotted exactly as before and to the identical "ampere scale." The problem immediately at hand is to determine the locus of the vector representing the voltage across AB (Fig. 1) when the voltage across CD is kept constant. By the well-known reciprocal-vector method this locus is found to be the circle SRQ. The center and radius of this circle can conveniently be located by means of the "image circle" $E_g E_o E_p$ (reflection of the original voltage circle through the vertical plane), since its center lies on the line joining the origin of co-ordinates M to the center of the "image circle," and its tangent vector MS is determined from the relation $MS/ME = ME/MV'$, MV' being tangent to the "image circle." Point S is located graphically as the intersection with the tangent line MV' of a line $E'S$ drawn parallel to the line $V''E''$. The radius of the "reduced voltage circle" is ST and its center is T.

Since any point (such as Q) on the circle $SRQU$ shows the extremity of the vector of the voltage across AB (in Fig. 1) when measured from M as the origin of co-ordinates, and since ME (of Fig. 3) is the vector of the constant voltage across CD (in Fig. 1), it follows that the vector difference between these two vectors (EQ in Fig. 3) is the vector representing the voltage consumed in the primary impedance—CD of Fig. 1.

Since the voltage vectors have been plotted to the "ampere scale" (with the primary impedance as the constant of conversion) it follows that the circle $SRQU$ (of Fig. 3) would become the locus of the extremity of the vectors representing the *value* of the primary current (equal to the voltage consumed in the primary impedance) if the point E were used as the origin of co-ordinates. Moreover, the correct *time-phase* relations (as well as numerical values) between the primary current vectors and the impressed primary (constant) voltage vector would be given immediately by shifting the reference voltage vector through an angle equal to the "primary impedance angle."

The above-mentioned time-phase and primary current value relations are correctly represented in Fig. 3 by the circle $P'''O'''G'''$ which is identical in size and significance with circle RQU inverted and shifted so that the initial origins of co-ordinates M and E are located at points E''' and M, the angle EME''' being the "primary impedance angle."

A comparison of Fig. 3 with Fig. 2 will show that the circle $P'''O'''G'''$ is identical in size, location and significance with circle $P'''O'''G'''$ of Fig. 2. Moreover, the exact physical and graphical significance of certain relations touched upon in connection with the development of Fig. 2 become self-evident from an examination of Fig. 3.

A most advantageous feature of the similarities here established resides in the fact that one can construct graphically with the minimum of labor the "reduced voltage circle" and, by giving this circle the correct time-phase position with reference to the constant primary voltage vector, can utilize it at once as the "reduced primary current circle." This feature is brought out more forcibly, and given greater emphasis, in connection with Fig. 4.

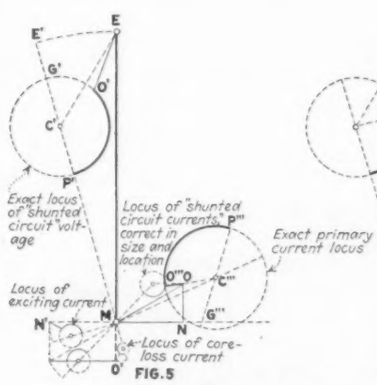


FIG. 5

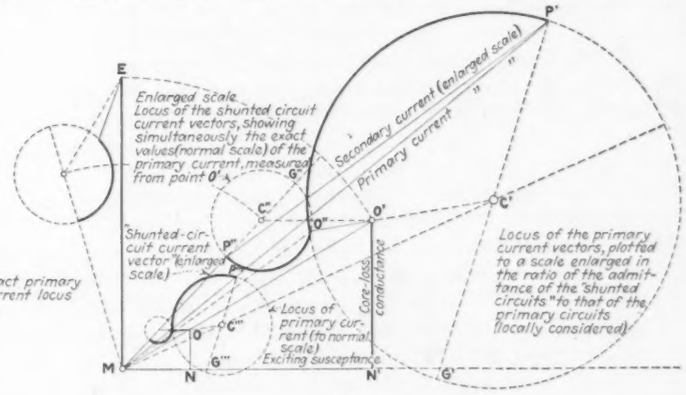


FIG. 6

FIG. 5—VECTOR RELATIONS BETWEEN THE SHUNTED-CIRCUIT VOLTAGE AND CURRENTS, THE PRIMARY CURRENT AND THE SECONDARY CURRENT, PLOTTED TO NORMAL SCALE. FIG. 6—SIMPLE GRAPHICAL METHOD OF DETERMINING THE EXACT RELATIONS VECTORIALLY BETWEEN THE PRIMARY, SECONDARY AND SHUNTED-CIRCUIT CURRENTS, PLOTTED TO ENLARGED SCALE

Diagram for Combined Reduced-Current and Reduced-Voltage Locus

In constructing Fig. 4 the line ME' is drawn equal to the vertical line ME (which is plotted in "amperes" to equal $E \div Z_p$) and displaced from this line by the "primary impedance angle," as shown. The line MX is laid off perpendicular to ME', and the line ZM is drawn displaced therefrom by the "primary impedance angle." Along the line MZ the distance MN is laid off to equal the exciting current (if full voltage E were impressed across AB in Fig. 1), and the line NO is laid off to equal the core-loss current under the same assumed conditions. The circle OPK is then drawn with its center on the line passing through the point O and parallel to ZN, and having a diameter $OK = E \div X_s$, all values being plotted to the "ampere scale."

The circle OPK is the locus of the extremity of the vector (measured from M as the origin of co-ordinates),

representing the primary current when the voltage is kept constant across *AB* in Fig. 1. This circle is simultaneously the locus of the extremity of the vector (measured from *E'* as the origin of co-ordinates), representing the voltage across *CD* (in Fig. 1) under the same conditions. Hence the circle *OPK* of Fig. 4 and the points *M* and *E'* of the same illustration are identical in size, significance and relative positions with the circle $E_o E_p E_k$ and the points *E* and *M* of Fig. 3.

The method of constructing the "reduced-voltage" circle in Fig. 4 is identical with that used with Fig. 3, resulting immediately in the construction of the "reduced-current" circle proper in both size and location. For any point on the original current locus (such as *O*) there is a corresponding point on the reduced-current locus (such as *O'''*) found at the intersection of the reduced-current circle by a line from the point chosen to the origin of co-ordinates *E'*. Similarly the point *S* on the reduced locus corresponds to the point *V* on the original locus, and the points *P'''* and *G'''* correspond to the points *P* and *G* on the original circle.

In case one desires to determine the location of the original circle as the locus of the extremity of the current vectors plotted in the proper time-phase relation with respect to the voltage vector *ME* of Fig. 4, he can draw the "image" of the original circle of Fig. 4 reflected through the plane shown at *MX*, thereby obtaining a circle identical in size and location with the original current locus shown in Fig. 2.

SHUNTED-CIRCUIT CURRENT AND VOLTAGE LOCUS IS READILY FOUND

As mentioned above, one can determine the locus of the "shunted-circuit current" (combined core loss and exciting current) from the locus of the voltage between *A* and *B* (of Fig. 1) when the voltage across *CD* is kept constant. In Fig. 5 the locus of the "shunted-circuit voltage" (across *AB* of Fig. 1) is shown as the circle *P'O'G'*. The locus of the exciting current and that of the core-loss current are constructed therefrom in the well-known manner, *MN'* being laid off to equal in value the constant voltage, *E*, divided by the exciting-circuit reactance (multiplied by the exciting susceptance), and *MO'* being made to the constant voltage, *E*, divided by the core-loss resistance (multiplied by the core-loss conductance). The vector addition of those two loci is the resultant "shunted-circuit" current locus, which is (as is self-evident) a replica of the locus of the shunted-circuit voltage drawn to a scale altered in the ratio of *MO* to *ME* (where *MO* is the shunted-circuit current at full voltage, *E*, across the shunted circuits and hence equals the admittance of the shunted circuits combined) and displaced therefrom by an angle *OME*, which is the "shunted-circuit admittance angle."

DERIVING THE SECONDARY-CURRENT VECTORS

Evidently it is possible to utilize the locus of the "shunted-circuit voltage" as the locus of the "shunted-circuit current" itself by shifting its time-phase position through the "shunted-circuit admittance angle" and selecting a proper scale for the current values, as was done before with the primary voltage and current loci. This plan is carried out in Fig. 6, where the "shunted-circuit admittance angle" is $EMO' = EMO$. In Figs. 5 and 6 the exact locus of the primary current (reduced) plotted to the original ampere scale is shown as the circle *P'''O'''G'''*. In Fig. 6 this same locus drawn to the enlarged scale (which is much more convenient for actual use) is shown as the circle *P'O''G'*. For every point (such as *P'*) on the enlarged locus of the primary current there is a corresponding point (such as *P''*) similarly located on the enlarged shunted-circuit current circle. The vector *MP'* is the corresponding primary current; the vector *MP''* is the corresponding shunted-circuit current, and the vector *P'P''* is the corresponding secondary current (reduced to primary terms) correct in both value and time-phase position.

Having established its accuracy and discussed its

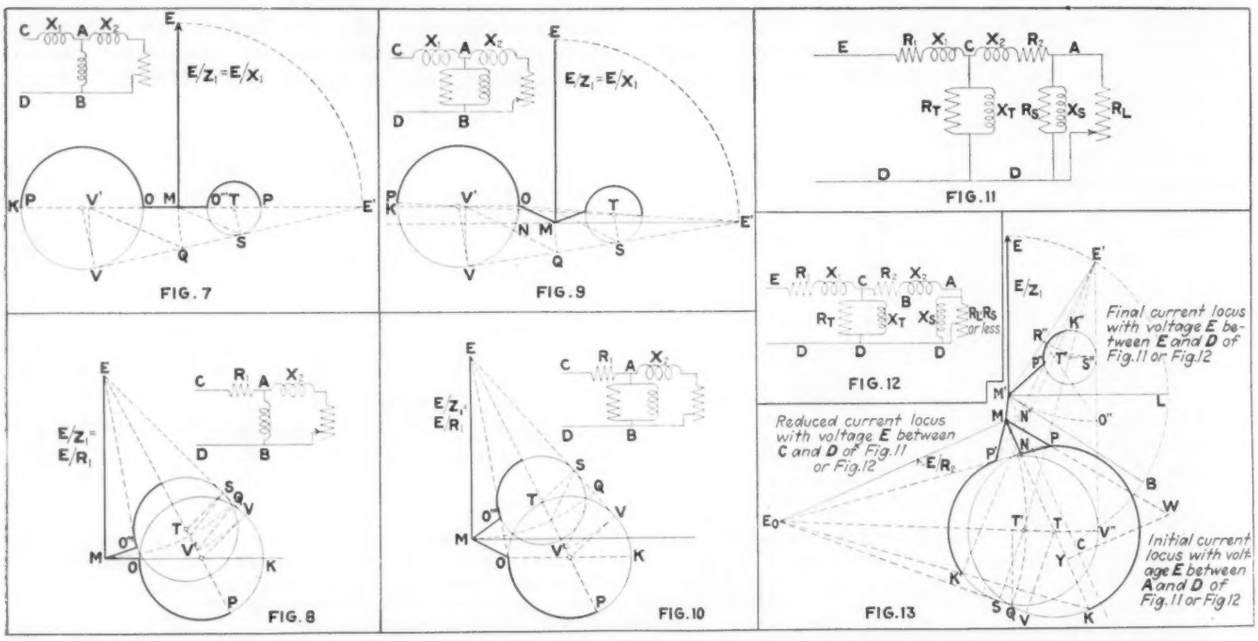


FIG. 7
FIG. 9
FIG. 11
FIG. 12
FIG. 8
FIG. 10
FIG. 13
Final current locus with voltage E between E and D of Fig.11 or Fig.12
Reduced current locus with voltage E between C and D of Fig.11 or Fig.12
Initial current locus with voltage E between A and D of Fig.11 or Fig.12

FIGS. 7, 8, 9 AND 10—FOUR COMBINATIONS OF SERIES AND SHUNT RESISTANCES AND REACTANCES, WITH THE CORRESPONDING GRAPHICAL DETERMINATIONS OF THE CURRENT LOCI RELATING THERETO. FIG. 11—ELECTRIC CIRCUITS OF WHICH FIG. 13 SHOWS THE CURRENT LOCI. FIG. 12—CIRCUITS OF FIG. 11 REPLOTTED BUT NOT MODIFIED. FIG. 13—GRAPHICAL CONSTRUCTION OF CURRENT LOCI CORRESPONDING TO THE CIRCUIT, FIGS. 11 AND 12

more important details by means of its application to a specific problem relating to the well-known equivalent electric circuits of the polyphase induction motor, it seems appropriate to show briefly the manner in which the general method herein developed can be utilized in the solution of numerous other electric problems, especially those of extreme values in circuit constants, together with the results obtained thereby.

SOLUTION OF CIRCUITS WITH EXTREME VALUES OF CONSTANTS

In Figs. 7 to 10 are shown certain extreme cases of circuit constants and the graphical solutions to the problems relating thereto, the method employed being identical in every respect with that used with the circuits shown by Fig. 1 and the solution thereto shown in Figs. 2, 3 and 4. To one acquainted with the well-known method of "inversion" for taking into account the effect of primary resistance on the current locus of the induction motor, Figs. 8 and 10 herewith will seem very familiar. The fact of the matter is that the graphical method herein developed is a general one unlimited in its application to alternating-current circuit problems, and the method already in use can be considered as a specific application of the general method to a limited portion of the complete problem. The method herein described is not limited to resistance in series but can be applied at once to resistance in series (or in parallel) or to impedance having any relation whatsoever of its resistance and reactance (either inductive or condensive) components in either series or parallel.

As showing the application of the general method to circuit problems in general, there is presented in Fig. 13 the graphical solution of the problems relating to the interconnected circuits illustrated in Fig. 11, which for convenience in explanation of the solution has been replotted without modification in its essential interconnections in Fig. 12. In solving the problems the circuit voltage is assumed to be impressed successively between A and D, between C and D and between E and D of Fig. 12 (which is identical with Fig. 11). In actually constructing Fig. 13 the angle $EM'E' = LM'B = BM'C$ is laid off as the "primary impedance angle." YMW is laid off equal to the "impedance angle" of the combined circuits R_s and X_s of Fig. 11, and $MM'N'$ is laid off equal to the "impedance angle" of the combined circuits R_t and X_t of Fig. 11.

With R_1 having an infinite value, MP represents the current through R_s and X_s with voltage E across A and D; with the voltage across C and D this current reduces to MP' with the current MM' through the circuits R_t and X_t; when voltage E is impressed across E and D in Fig. 11 this current reduces to $M'P''$, which is represented in Fig. 13 correct both in value and time-phase position with reference to the impressed voltage E, represented by the vertical line $M'E$. The method of locating other points on the several current loci is self-evident and need not here be carried out in detail.

In view of the ease with which the general method can be applied to any specific problem related to interconnected alternating-current circuits, it is believed that it will prove of value to all persons interested in interconnected alternating-current circuits and especially to those interested in graphical methods of solving such problems.

Eternal Vigilance in Maintenance Work Important

Periodic Inspections Are Made by Patrolmen Who Have No Connection with Maintenance Work—Record Forms that Are Useful

BY F. H. BATES
Assistant Manager Ohio Service Company, Coshocton, Ohio

NOTHING is more effective in reducing avoidable interruptions on high-tension systems having moderate voltages than eternal vigilance combined with common sense. There should be a definite time set for the periodical inspection of every piece of apparatus connected with the high-tension system, and that schedule should be adhered to rigidly. Changes in the schedule should be made whenever experience proves that inspections are not frequent enough. By supplementing a good inspection schedule with an automatic system for following up repairs interruptions will be reduced to a minimum.

Experience on a medium-sized system operating over three counties and serving twenty-two towns has demonstrated the value of such methods. The main trunk lines operate at 33,000 volts, while the feeders radiating from the trunk lines operate at both 33,000 volts and 13,200 volts. The load supplied is mainly power.

Too much stress cannot be laid upon the importance of patrolling the lines regularly and inspecting all other high-tension apparatus periodically. The plan of having the sections patrolled by linemen from the various districts has been tried out and found unsatisfactory. The press of work in the district often caused the patrol to be postponed and sometimes neglected altogether. Linemen were prone to take chances; that is, small defects which appeared to be of minor importance were sometimes not reported, and later these defects would become a source of trouble. It was not always practical to send the same man out each time to make the inspection, and there was always the tendency to pass by a fault and let some one else report it. Thus the division of responsibility crept in, and it was felt that the thing to do was to add to the organization a man whose sole duty was to inspect the lines.

PATROLMEN SPECIALLY TRAINED

It was decided to try out a man who had no experience in line work. The idea was that if such a man were properly coached and impressed with the importance of the work good results would be obtained. An experienced lineman on patrol duty is sometimes inclined to rely on his own judgment as to the necessity of certain repairs, and if his judgment is faulty, an interruption probably follows. With the plan as it is working at present, however, if the patrolman sees a defect, he reports it at once, and it is then up to the district superintendent to see that the repair is made. The fact that the patrolman does not have to help make the repairs is another very good reason why he does not hesitate to report everything that comes to his attention.

It is good practice for the district superintendent occasionally to inspect his own section, and the men who are responsible for the operation of the system as a whole should also walk the lines every few months.

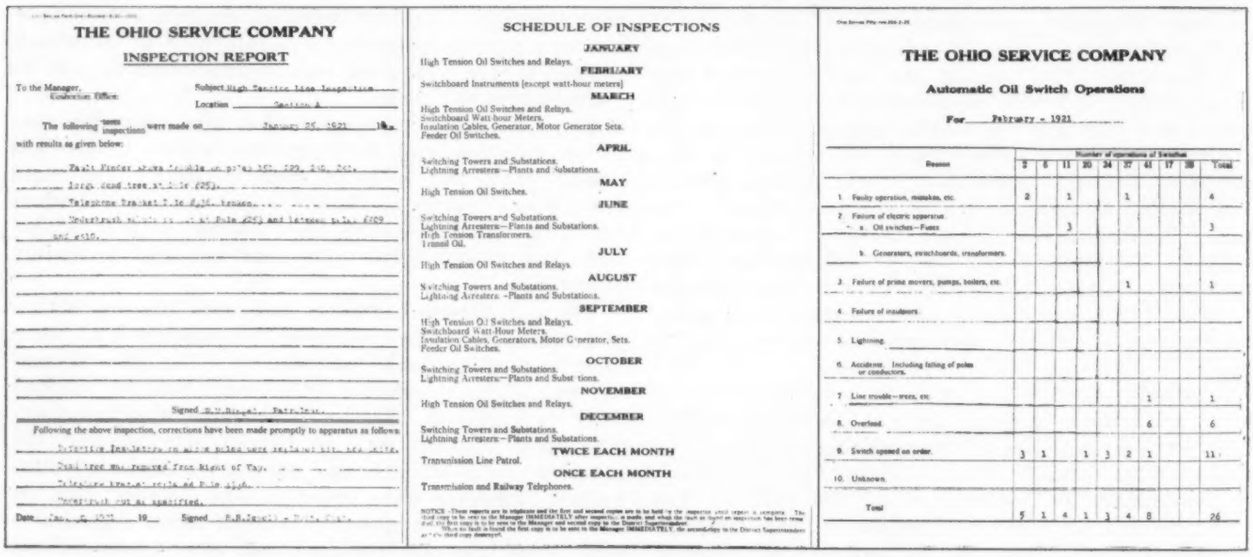
It has been found that keeping underbrush cut down

in the right-of-way is good practice. If the right-of-way is clear, the patrolman has no reason for skipping any portion of the line.

All high-tension systems must contend more or less with the insulator failures caused by hunters using the insulators as targets. It has been found that this can be prevented to some extent by posting signs at frequent intervals along the lines offering a reward for information leading to the arrest and conviction of the offender. If any such interruptions do occur, newspaper publicity of the right sort will help educate the public against the practice. It is also well to get acquainted with the farmers along the line and explain to them how much trouble can be caused by shooting at an insulator. The farmer living close to the line can be made a sort of an amateur patrolman. If he is told what to look for, he will often discover defects; official should then check up immediately to see what has delayed the work and endeavor so to arrange matters that there will be no further delay. Without a good follow-up system some work would be forgotten or neglected, with disastrous results.

Assuming that repairs are always made with the lines dead, arrangements should be made to kill the section where defects are discovered as soon as possible after they are reported. Sunday is the one day when repairs can almost always be made, but it is not always good practice to wait until Sunday. Interruptions can often be made late at night without inconvenience to consumers, and with the aid of powerful battery searchlights night repair work is practicable.

Any suspicious noise on the telephone system should at once be investigated, since it is often an indication of a fault on the transmission line. By sectionalizing



THE OHIO SERVICE COMPANY

INSPECTION REPORT

To the Manager, Connection Office: Subject High Tension Line Inspection

Location Section A

The following items were inspected on January 25, 1921 19..

with results as given below:

Pearl Finder strung trouble on poles 125, 129, 210, 201, Iorgs dead tree at pole 225. Telephone transmitter pole 216, broken. Underbrush trimmed at Pole 205 and letter to Mr. Ford sent.

Signed R. W. Ricard, Patrolman.

Following the above inspection, corrections have been made promptly to apparatus as follows:

Insulation Insulators on above poles were replaced but not wired. Dead tree was removed from Right of Way. Telephone transmitter pole 216 repaired. Underbrush trimmed as specified.

Date Jan. 26 1921 19.. Signed R.B.Jewell - Dist. Supt.

SCHEDULE OF INSPECTIONS

JANUARY
High Tension Oil Switches and Relays.

FEBRUARY
Switchboard Instruments (except watt-hour meters)

MARCH
High Tension Oil Switches and Relays.
Switchboard Watt-hour Meters.
Insulation Cables, Generator, Motor Generator Sets.
Feeder Oil Switches.

APRIL
Switching Towers and Substations.
Lightning Arresters—Plants and Substations.

MAY
High Tension Oil Switches.

JUNE
Switching Towers and Substations.
Lightning Arresters—Plants and Substations.
High Tension Transformers.
Transil Oil.

JULY
High Tension Oil Switches and Relays.

AUGUST
Switching Towers and Substations.
Lightning Arresters—Plants and Substations.

SEPTEMBER
High Tension Oil Switches and Relays.
Switchboard Watt-Hour Meters.
Insulation Cables, Generators, Motor Generator, Sets.
Feeder Oil Switches.

OCTOBER
Switching Towers and Substations.
Lightning Arresters—Plants and Substations.

NOVEMBER
High Tension Oil Switches and Relays.

DECEMBER
Switching Towers and Substations.
Lightning Arresters—Plants and Substations.

TWICE EACH MONTH
Transmission Line Patrol.

ONCE EACH MONTH
Transmission and Railway Telephones.

NOTICE—These reports are in triplicate and the first and second copies are to be held in the inspector until report is complete. The first copy is to be retained in the Manager IMMEDIATELY after completion of report and when the fault or fault are corrected. The second copy is to be retained in the Manager and second copy on the Superintendent IMMEDIATELY after completion of report. When no fault is found the first copy is to be sent to the Manager IMMEDIATELY, the second copy to the District Superintendent and the third copy destroyed.

THE OHIO SERVICE COMPANY

Automatic Oil Switch Operations

For February - 1921

Reason	Number of operations of Switches: 2	6	11	20	24	37	41	17	39	Total
1. Faulty operation, mistakes, etc.	2		1			1				4
2. Failure of electric apparatus: a. Oil switches—Fuses			3							3
b. Generators, switchboards, transformers.										
3. Failure of prime movers, pumps, boilers, etc.						1				1
4. Failure of insulators.										
5. Lightning.										
6. Accidents. Including falling of poles or conductors.										
7. Line trouble—trees, etc.							1			1
8. Overload.							6			6
9. Switch opened on order.	3	1		1	3	2	1			11
10. Unknown.										
Total	5	1	4	1	3	4	8			26

PERMANENT RECORDS OF INSPECTIONS AND TROUBLES AID IN IMPROVING SERVICE
On the right is a record of the oil-switch operations for a month; on the left is shown the inspection report, while on the back of this report (center) is the schedule of inspections.

and if he is paid a nominal sum, say $5 for each interruption prevented, he will be sure that the company is notified immediately in case he sees anything unusual on the line.

The transmission-line telephone is the lifeblood of the system. It must be kept in the best of repair at all times. The patrolman should be instructed to watch for defects on the telephone line as carefully as he watches the transmission line.

The method of reporting defects and following up the repairs is as important as the inspection itself. Every inspection should be scheduled for a certain time, and it should be the duty of some one in the organization to watch the schedule and if an inspection is not made on time, to find out the reason. It has been found good practice to have all reports made out in triplicate—two copies going to the man responsible for the repair work and the third copy being kept in the general office. The repairs having been completed, one copy of the report is mailed to the general office, signed by the man in charge of the work, the other copy being retained in his files. The triplicate copy can then be destroyed. If at the end of a certain period of time the signed inspection report is not received in the general office, the triplicate copy should automatically come to the attention of the proper official. This the telephone in such cases it can be determined on what section the noise originates, and a patrol of that section should then be made. Sectionalizing switches are invaluable when trouble comes, but they must be inspected and tested often or they may develop trouble within themselves or fail to operate when needed. Relays, lightning arresters and all other substation equipment must be watched closely. The settings of the relays are highly important and should be readjusted whenever conditions on the system warrant a change. The man responsible for the relay settings should be at all times in touch with general operating conditions over the system.

The load dispatchers should make occasional trips over the system so as to be acquainted with conditions at the various substations. Then when emergencies arise they can readily visualize the situation and decide what should be done to resume service in the shortest possible time. If line foremen from various districts are acquainted, they will work together better when an extreme emergency in one district makes it necessary to send in men from other districts.

Such interruptions as do occur should be carefully analyzed and monthly reports made up showing the reason for every switch operation. Much can be learned from a record of this kind.

Simplicity in Outdoor Substation Layout

Extremely Flexible Switching Has Been Attained with a Simple Layout in the Outdoor Substations of the San Joaquin Light & Power Company—Towers Used for the Purpose of Cooling Transformer Circulating Water

By L. J. MOORE
Electrical Engineer San Joaquin Light & Power Company

SIMPLICITY carried to the furthest point that does not cause attendant loss of flexibility should be the keynote of design in laying out high-voltage outdoor substations. With this requirement in mind a study of the outdoor substations which were laid out as a part of the Kerckhoff power project by the San Joaquin Light & Power Company may be of interest. Some of the features of these substations are the use of oil switches with a pantograph break, cooling towers for transformer circulating water, auto-transformer windings for 110-kv. to 66-kv. transformation, switches to ground the lines substantially, and transformers having a special winding to eliminate harmonics and inductive interference.

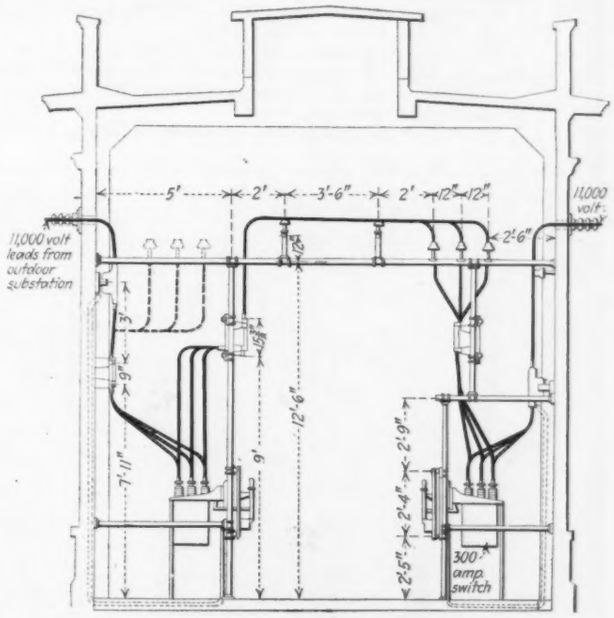
Construction of three new substations, at Merced, Sanger and Corcoran, Cal., has been completed. A fourth, of the same design, has been built at Semitropic to take the output of the new gas-burning steam plant which the company is erecting at Button Willow.

Inasmuch as the transmission voltage from the Kerckhoff* power house was fixed at 110,000, and since the original transmission system of the company was at 66,000 volts, it was decided to step down the voltage at each substation from 110,000 to 66,000 volts. In order to provide for local distribution from each station, the transformers were equipped with 11,000-volt windings, the rating of which is a small part of the total capacity. Thus the original system of 66,000-volt transmission has been preserved as a sort of secondary transmission system and the 110,000-volt line superimposed upon it as a large-capacity bus. As additional generating capacity and load are added to the system it is planned to construct a second 110,000-volt line along almost the same route as the first in order to provide a duplicate bus and allow the use of balanced relays in the sections between substations, thus insuring the best possible service.

ALL SUBSTATIONS BUILT ON SAME GENERAL PLAN

All of the substations are built on substantially the same plan, therefore a description of one will apply to all. The Sanger substation will become the most important one on the system as time passes because it is so located that all the transmission lines from Kings River plants can be brought into it. The Kings River project furnishes the company's most important prospective power sites. All lines from these plants will probably enter Sanger, and a number of radiating 110-kv. lines will be carried out from that station in addition to the duplicate line arrangement already mentioned. The drawings accompanying this article refer to the Sanger installation primarily, although some of the photographs are from the Corcoran substation.

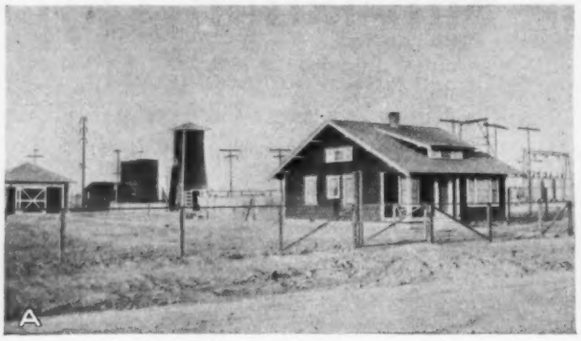
Although the substations are of the outdoor type, all high-tension buses, switches and transformers being installed out of doors, a small reinforced-concrete building has been provided to house the 11-kv. feeder switches, all metering and relay equipment and the storage battery for tripping the high-tension switches. From the ground plan it will be seen that the 110,000-volt and 66,000-volt buses parallel each other on opposite sides of the high-tension yard. Sufficient space is left between them to allow the step-down transformers, with their necessary switches, to be installed between.

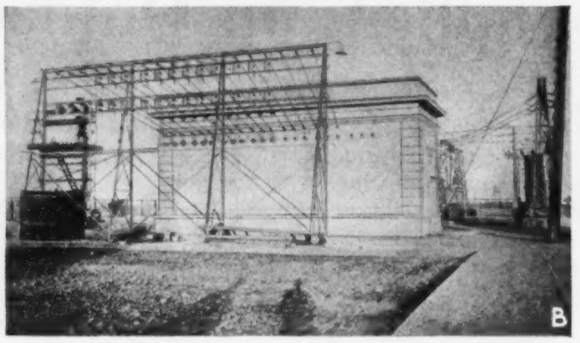


ELEVATION OF BUILDING, SHOWING 11,000-VOLT SWITCHING

The first units of the two buses and switches have been installed at one end of the yard, and all further extensions will be made in units toward the opposite end of the property. In this way the step-down transformers will be installed in a continuous row, and the transformer track will enable one single-phase spare transformer to afford protection for all banks. At the present time a single bus only has been provided on each of the 110-kv. and the 66-kv. lines. However, ample space for future needs has been left, and as the number of incoming lines increases a transfer bus of either voltage or of both voltages may be installed to provide for the by-passing of the station, inspection of switches and similar requirements. At stations from which it is not apparent that any 110-kv. lines will be run, except the two main buses already mentioned, it is planned to build the 110-kv. station bus in two sections with two switches per section, as shown on the drawings, with, say, one line from the north and one from the south connected to each section. A disconnecting air-break switch will then be installed

*See ELECTRICAL WORLD, Feb. 26, 1921, page 471, and March 19, page 641.





Typical Outdoor Substation Construction on System of San Joaquin Light & Power Corporation

A—Operator's cottage at the Corcoran substation, showing the tank house, cooling tower and garage in background.

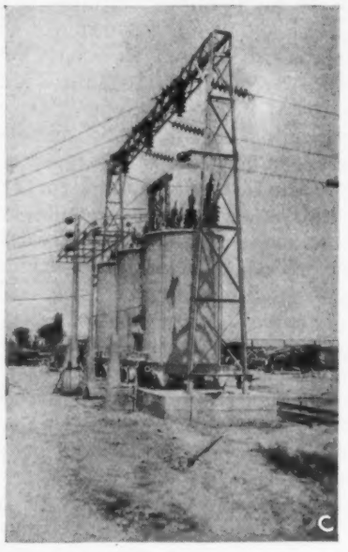
B—Outdoor transfer structure for the 11,000-volt feeders at the Sanger substation.

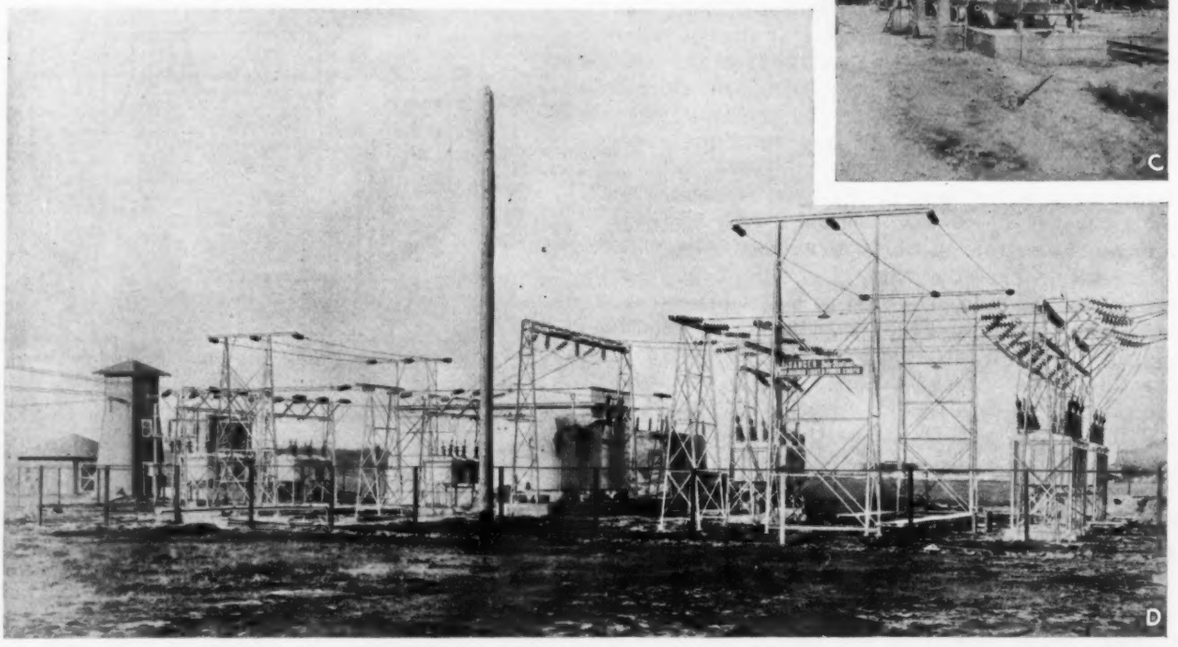
C—Transformers are rated at 5,000 kva. and step down the voltage from 110 kv. to 66 kv. and 11 kv.

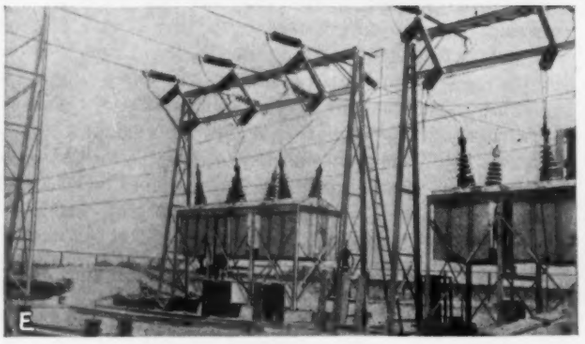
D—Four substations of this general type have been built by the San Joaquin Light & Power Company. The station shown is at Sanger, Cal.

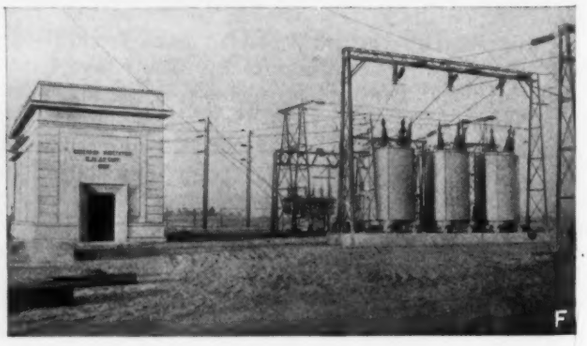
E—Oil-switch and disconnecting-switch structure for the 110-kv. line at the Sanger substation.

F—Corcoran substation, showing building and outdoor structures.





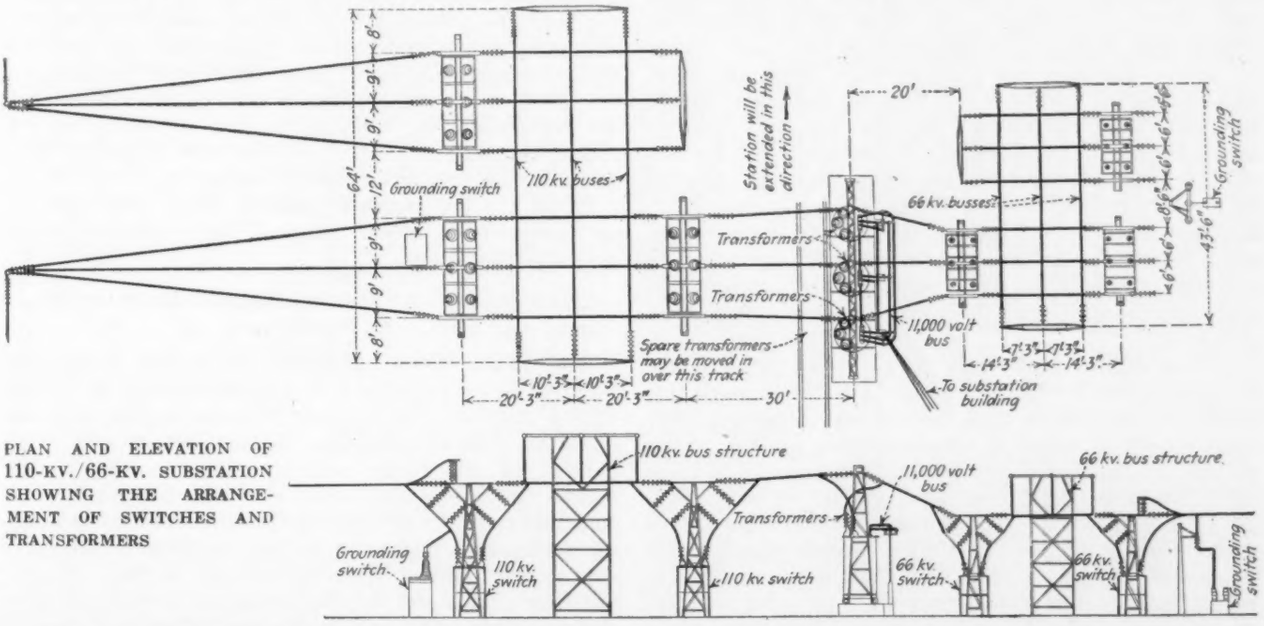




between the sections of the bus. When the switch is opened two 110-kv. lines will pass through the stations, but they will be separated from each other. This arrangement was considered to provide enough flexibility for the small substations.

Oil Switches Are Pantograph-Break Type

The high-tension oil switches for both voltages are the outdoor type and have a pantograph break, permitting high speed of operation. The tanks are large and deep, so that the break is made under a high head of oil, and the blades are thin and are inserted at right angles to the direction of motion, so that small disturbance occurs in the oil when the switch opens. The 110-kv. switches are of much greater capacity than the 66-kv. switches and have two pantographs per pole, thus having a total of four breaks per phase. At the present time the switches are all hand-operated, but as the station grows it is expected to change them all to electric operation. The tripping on overloads is now



PLAN AND ELEVATION OF 110-KV./66-KV. SUBSTATION SHOWING THE ARRANGEMENT OF SWITCHES AND TRANSFORMERS

done by a 32-volt storage battery, and for that reason alternating-current instead of direct-current solenoids may be installed because the present battery has insufficient capacity to close the switches. Hand operation would still be possible should there be no source of alternating current available for a short interval of time. The oil switches were manufactured by the Kelman Electric Company of Los Angeles.

A portable synchroscope has been provided so that the operator can synchronize with the hand-operated switches. Single-phase potential transformers have been installed on the lines and at the low-tension side of the station transformers. Potential leads are brought into the building, the usual synchronizing and voltmeter receptacles being placed on a panel on which are also mounted the mimic bus and indicating lamps showing the position of the oil switches. Bright-light synchronizing has been provided, and the synchronous buses are carried out of the building to receptacles at each of the high-tension oil switches. These receptacles, however, simply provide a means for plugging the portable synchroscope on to the synchronizing bus. The synchroscope is then hung up on the bracket on the switch and the operator is able to synchronize incoming lines.

To synchronize, the operator plugs in between two potential transformers on opposite sides of the open switch on the mimic bus panel inside the station building. He then takes his portable synchroscope and goes out to the open switch, plugs his synchroscope into the receptacle and synchronizes. Bright-light synchronizing was adopted because in case of the failure of the lighting supply of the station the operator would have light at the instant the synchronizing pointer showed synchronism, thus making it possible for him to synchronize even though his station were in darkness.

Switches Provided for Grounding Line

The high-tension disconnecting switches, as will be noted from the photographs, are hung on towers installed over the oil switches. These disconnecting switches are of single-pole, single-throw type and are all provided with locks. On each of the outgoing lines a three-pole, single-throw grounding switch is installed which provides for grounding the lines when they are open for repairs. It is planned to install by-passing air switches on top of the switch towers at some of the stations to provide for the inspection and repair of switches which cannot otherwise be taken out of service. It will be noted that disconnecting switches are not installed on both sides of the oil switches. The omission is not intentional, but was merely because the delivery of post-type insulators was so slow that the job was not completed when the photograph was taken.

The station transformers are of the single-phase, 5,000-kva. outdoor type. The transformation from 110,000 to 66,000 volts is effected by means of an auto-transformer winding, the ratio being 63,510 to 40,100 and the three single-phase transformers being connected in star. Neutral connection to ground is made through a disconnecting switch, and thus either isolated neutral or grounded neutral operation may be had. A 6,600-volt winding has been provided of 20 per cent of the main transformer capacity and 20 per cent impedance, based on full load in the main transformer

winding. These windings will be connected in delta to provide a path for the triple harmonics in the transformer wave. Thus the triple harmonics will be kept off the line and inductive interference with telephone circuits reduced. A third winding rated at 1,650 kva. per transformer and voltage of 6,600 has been provided for grounding Y-connections to 11,000-volt circuits. This winding will care for the local distribution from each station. Leads from it pass into the substation building, where the 11-kv. feeder switches and meters are installed.

TRANSFORMER CIRCULATING WATER COOLED WITH TOWER

It was decided to use oil-insulated, water-cooled-type transformers, and because all four of these substations are installed in country districts where no water supply is available, a complete water-cooling system was installed at each station. This system consists of a well and an elevated supply tank, a cooling tower and two duplicate pumps. The piping system is so arranged that either pump may pump from the well into the supply tank or from the well through the transformers or simply circulate the cooling water from the pond underneath the cooling tower through the transformers and back over the tower. In this way very reliable operation should be obtained. A float switch in the elevated supply tank operates the motor which is pumping from the well to the tank so as to keep a practically constant level in the supply tank at all times. The other pump will be used in the ordinary operation to circulate water from the cooling tower through the transformers and over the tower as has already been indicated.

An automatic float valve in the pond beneath the tower provides for the admission of water through this pond from the supply tank, thus always keeping a sufficient supply of water in the circulating system. Flow meters are being installed on the transformers to make sure that each transformer shall get its necessary supply of cooling water. The ordinary funnel type of flow meter usually applied to station transformers is not applicable because of the fact that a slight head is maintained on the transformer coils in order to force the discharge over the cooling tower. Irrigation water for the operator's garden may be supplied by pumping from the well directly to the transformers, either discharging at that point into an irrigating ditch or carrying the water on over the cooling tower and discharging from the pond into the irrigating ditch.

ADDED INVESTMENT FOR WATER-COOLED TRANSFORMERS FOUND TO PAY

The pumps and cooling tower installed will take care of four 15,000-kva. banks, or a total of 60,000 kva. in transformer capacity. The complete equipment for the circulating water, exclusive of what would ordinarily be necessary for supplying water for domestic use at the operator's cottage, costs approximately $2,700. The annual charges on this investment, interest at 9 per cent, depreciation at 4 per cent and maintenance at 2 per cent, make a total of $405 per year. Assuming that 4 hp. is necessary to circulate the water for all banks of transformers, and figuring this continuously throughout the year, the actual cost of generating power is shown to be $165.50 per year. The total annual cost, then, is $570.50. On a capitalization basis of 15 per cent these figures indicate $3,770 as the additional first cost of transformers had they been air-cooled instead of water-cooled. This amounts to about 5.13 cents per kva. of the 60,000 kva. total rating. As this is much less than the manufacturer's difference in price per kva. between these types of transformers a considerable saving was effected by this cooling method.

Complete relay protection has been installed at all these stations. All of the high-tension oil switches are provided with bushing-type current transformers for relay operation. Reverse power relays are installed on all lines and will be set to operate for outgoing power from each substation bus only. In this way transmission-line trouble on any line passing out from a substation will trip the switch on that line only. The main 110-kv. lines which pass through the stations will have balanced protection when the second line is built. At the present time, however, only one contact of the double-contact relays for that purpose will be utilized and the relay will be so connected that outgoing power only will close the contact. The 66-kv. lines will operate on the same sort of protection. The station transformers are protected by overload relays differentially connected across the current transformers on the two transformer switches. These relays will be set high enough to prevent the ordinary load on the 11-kv. feeders from operating the high-tension oil switch on the transformers. All 11-kv. feeders are protected with transformer trip coils on the switches. The switch between the transformers and the 11-kv. bus operates on current-transformer tripping, with circuit-opening plunger-type relays.

THE 11,000-VOLT FEEDER SUPPLY INDEPENDENT OF SUBSTATION

The 11-kv. feeder switches inside the substation building are all mounted on pipe framework as shown in the drawing. An outdoor transfer bus is provided on 11-kv. feeders, thus allowing any two circuits to be carried off one feeder switch while the other feeder switch is inspected or repaired. This transfer bus is installed outdoors in order to provide for the cleaning of insulators, bushings and other equipment. The station power tank of transformers for feeding the circulating pumps and the station lights is equipped with double-throw switches between the indoor and outdoor 11-kv. buses. In this way it will be possible in case of a complete shutdown of the 11,000-volt part of the substation to feed the water-supply system from another substation over one of the interconnecting 11-kv. lines. This lighting and power transformer bank is mounted on a pole alongside the pump house. The power transformers are rated at 6,600 volts primary and are connected in star for 11,000 volts. The lighting transformer is single-phase, 11,000 volts.

This method of mounting combination lighting and power transformers is the same as that adopted for rural distribution and is a standard with the company for all service where transformers are not more than 10 kw.

These substations were designed by the writer and constructed by the operating department of the San Joaquin Light & Power Corporation under the supervision of the writer and E. A. Quinn, general superintendent.

The main transformers are Allis-Chalmers, while the 11-kv. switching equipment is General Electric Company and the main relay equipment is divided between the General Electric and Westinghouse Companies.

Power-Factor Rate that Works Both Ways

Consumer Credited for Power Factor Above Base and Penalized If Below—Capacity Charge Based on Kilovolt-Ampere Demand

BY M. L. SINDEBAND
Electrical Engineer American Gas & Electric Company

IN THE past the structure of the power rates was such that it imposed a considerable burden on public utilities, the reason being that the rate was based entirely on an energy charge. Today, however, the structure of the rate for power is being considered in a new light. This rate consists of two elements, namely, a capacity charge and an energy charge, the capacity being figured in terms of kilovolt-amperes instead of kilowatts, thereby taking into consideration the power factor of the consumer's installation. It may be very readily seen that not only does the power factor affect the capacity, but also has a great deal of influence on the losses, so that the public utility should be compensated for power factor in the energy charge as well.

A rate that is founded on a base power factor should benefit the consumer where the power factor is better than the base. This is particularly true in that part of the rate dealing with the effect of power factor on the energy charge. In such a case the consumer should be credited with the saving due to a higher transmission efficiency.

In taking into account the power factor the question comes up whether the average power factor for the month or the power factor at the time of maximum demand should be considered. As a rule, the power factor at the time of maximum demand is always a maximum, and it appears to me that the average power factor should be considered as basis instead of the maximum, because, after all, it is the average condition that counts.

In taking care of the energy charge one method that has worked out satisfactorily is embodied in the following considerations:

1. Assumption as to efficiency of transmission.
2. Assumption of a power factor which shall be used as a base value and up to which the public utility expects the consumer to work.
3. Determination of proper factors whereby a consumer will be penalized when his average power factor for the month is below the selected base value and credited when his average power factor is above the prescribed value, the penalties and credits being in the form of percentage of kilowatt-hours consumed.

In the development of a formula for these factors let P_1 = power delivered, P_2 = power input, and Q = per cent power loss based on delivered power. Then per cent efficiency of transmission = $100\ P_1/P_2$. Then P_2 may be reduced to terms of P_1 and substituted, giving:

$$P_2 = P_1(100 + Q)/100 \qquad (1)$$

Substituting, per cent efficiency of transmission = $(P_1 \times 100) \div P_1(100 + Q)/100 =$

$$10{,}000/(100 + Q) \qquad (2)$$

For penalty adjustment assume 85 per cent as a base line for power factor and an efficiency of transmission equal to 85 per cent at that power factor.

Substituting the assumed value of 85 for efficiency of transmission in equation (2), $85 = 10{,}000/(100 + Q)$. Therefore: $8{,}500 + 85Q = 10{,}000$. Solving, $Q =$ 17.65 per cent.

The above solution implies that with an efficiency of transmission of 85 per cent the per cent loss based on delivered power is 17.65 at a power factor of 85 per cent. To find the value of Q at any other power factor, 17.65 per cent would have to be multiplied by a factor equal to $0.7225/(\text{power factor})^2$.

With this arrangement if the average power factor is better than 85 per cent, the consumer is credited with the decrease in power loss. On the other hand, if the average power is less than 85 per cent, he is penalized with the increase in power loss. This is done by multiplying the kilowatt-hours consumed for the month by a factor given below:

For power factors above 85 per cent, the factor = $1 - [0.1765 - (0.1275/\text{power factor}^2)]$

For power factors below 85 per cent, the factor = $1 + [(0.1275/\text{power factor}^2) - 0.1765]$

In both of the foregoing formulas the power factor should be expressed as a decimal.

Power factor having been taken care of in the energy charge, the next point to consider is the capacity charge. Under this rate a consumer contracts for a certain number of kilovolt-amperes and by means of relays and switching equipment is held to this total, allowing for reasonable overload conditions. If he overdraws on the kilovolt-amperes for which he has contracted, his power supply will be interrupted. After several of these interruptions it is likely that he will go to the power company for an explanation where he can be told that he contracted for a certain number of kilovolt-amperes and that, owing to the bad power factor he has allowed, the total kva. for the required horsepower has increased. It can be explained that he can correct this condition in two ways—first, by installing corrective apparatus to compensate for the bad power factor, thereby reducing current; second, by contracting for more kilovolt-amperes, which, of course, means additional charges.

Rate schedules based on this principle are used in most of the territory that is served by the American Gas & Electric Company. In order to avoid the penalties imposed due to bad power factor the consumers have installed a very large number of synchronous and static condensers which have not only benefited them, both in regulation and lower rates, but have also relieved the generators, line and transformer equipment of a considerable amount of wattless current.

Data for Tilting of Circle Diagram

THE tilting of the circle diagram of the induction motor due to the effects of primary impedance was dealt with by R. G. Warner in the April 30 issue of the ELECTRICAL WORLD, page 980. For the benefit of any readers who may wish to check the results given or to investigate the matter further, attention is called to some typographical errors in the article. The notation under Fig. 3 should read: "The constants used in this case are $E_o = 100$," etc. This value of $E_o = 100$ applies to all three cases in the table. Under case 2 the approximate value of sin ϵ should be 0.199. The equation attributed to Specht should be $\tan \epsilon = \frac{I_o}{E}[r_1 + (x_1 + x_2) \cos \theta_o]$.

The upper diagram on page 980, which should have been designated as Fig. 1, is the exact equivalent circuit and the lower diagram, which should have been labeled Fig. 2, represents the approximate circuit.

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Architects' Plans Should Provide Adequate Convenience Outlets

To the Editor of the ELECTRICAL WORLD:

SIR: The writer recently examined plans issued by the Architects' Small House Bureau of Minneapolis. These were quite complete except for one important item. On one set of plans no "convenience outlets" were indicated in kitchen, dining room, sun porch, bathroom and two bedrooms.

Today nearly every house built is wired for electricity. Almost all of these homes are prospective customers for many electrical appliances. At our home we use the convenience outlet in the dining room about 400 times yearly, every morning for the toaster, many Sunday evenings for toaster or chafing dish. We should consider it an outrage to be compelled to climb on the dining table in order to connect the appliance to the chandelier whenever we wanted to use it. Would this not be a good subject to refer to the Society for Electrical Development and the other various electrical leagues, campaigns, etc., for action?

ISRAEL LOVETT,
Omaha, Neb. City Electrician.

Government Aid Needed in Study of Fire Waste

To the Editor of the ELECTRICAL WORLD:

SIR: Articles have appeared in the ELECTRICAL WORLD which criticised the placing of electricity first in the list of fire causes. While in some respects these criticisms may be justified, discussion of a more constructive kind would doubtless follow had the articles been written under a debatable title, such as "The Relative Importance of Electricity as a Fire Cause Based Upon Financial Losses Versus Numbers of Fires." Arguments advanced would probably apply equally to other fire causes.

Any discussion of the National Board of Fire Underwriters' lists, from consideration of which the criticisms emanate, should be predicated upon the intent of the publisher as well as upon the accuracy of the assertions made. A part of this information is obtainable by reading the text of the statements. It must also of necessity be influenced by the status and responsibility of this highly specialized insurance organization, having a due regard for the obligations of the stock insurance companies forming its membership to the various states which require certain definite statistical data upon which the lists are based. The value of any interpretations of statistics depends largely upon the application of the interpretations and the defensibility of the statistics. The probable errors of interpretations for any given period will increase with the variability of the elements in the statistics considered. If the elements vary widely during successive periods, errors may be further magnified until interpretations for one period may become absurd when applied to other periods.

The futility of rating the importance of fire causes for the entire country upon the financial losses alone can be readily demonstrated by citing a few examples. Thus, were the financial rating alone regarded, the most important cause of fires during the year of the San Francisco disaster might be designated as "earthquakes." Again, Mrs. O'Leary's cow of Chicago fame might receive the doubtful honor for another similar period. Other striking examples might also be mentioned. Since there are many conflagrations each year, the possibility of making misleading interpretations is readily understood.

In all of our conflagrations the exposure hazard, usually coupled with the action of a strong wind and other contributory circumstances, is more important than the original cause of the fire in explaining the large financial losses. That the exposure hazard can be greatly reduced is evident. This is exemplified in the fire statistics of one of the largest European cities, where during a period of fifty years no fire has spread beyond the confines of the building in which it originated. On the other hand, there is no large city in the United States which can show a similar record for even one year.

To bring about a marked reduction of fire waste more statistical data should be obtained upon features such as the numbers of fires with respect to fire causes, number of fires with respect to building construction and occupancy and so forth. Comparison of such data with the general conditions prevailing in the various occupations housed in the different types of buildings would then provide a tangible basis upon which a reduction could be predicated. This would also operate to place individual and collective responsibility for different kinds of fires where it properly belongs.

Up to the present time the absence of definite unbiased data covering any large portion of the country has resulted in much confusion and misinterpretation. The varying practices in different sections of the country have discounted the work of individuals and associations. Education of the public through local groups has failed to kindle the enthusiasm and interest necessary to promote a country-wide improvement. Even the so-called scientific statements regarding fire prevention are based upon widely varying assumptions depending upon the exigencies of the issues at hand. Practices are far from consistent because of the difficulty of obtaining similar data in a sufficiently large number of cases to provide a basis.

The various states do not have consistent laws which enable their variously collected statistics to be readily compiled. No state receives a report upon every fire occurring within its jurisdiction. The federal government is virtually inactive. Indeed, there is no one agency which obtains this information for the whole country, excepting in so far as the National Board of Fire Underwriters receives a large percentage of data in connection with fire reports from its stock insurance companies. This body, however, does not publish data upon any considerable percentage of the fire causes based upon the number of fires in their relation to occupancies.

The most authoritative federal statement upon any large number of fires analyzed with respect to fire causes appeared in a table published in Circular No. 75 of the United States Bureau of Standards, page 92. This table refers to statistics on 189,228 fires collected

from a number of state fire marshals' reports extending over several years. Of these only 4,191 (2.21 per cent) are attributed to electricity. Fifteen more important causes from the standpoint of numbers are given. "Unknown causes" stand first on the list, with a total of 40,824 (21.57 per cent), and are followed by "smokestacks, chimneys and soot," accounting for 14,645 fires (7.74 per cent). "Matches" are third, with a total of 14,449 fires (7.63 per cent). Then are placed the following causes in the order named: "Exposure or adjoining," "explosions," "sparks," "overheated materials," "ignition" (of certain inflammable materials), "lightning," "defective flues," "cigars, cigarettes and pipes," "incendiaries" (excepting children), "acts of children," "spontaneous combustion," "rubbish and bonfires." All of these causes exceed electricity in point of numbers. This is but one effort to interpret such data upon a uniform basis.

Electricity, with heat and other forms of energy, possesses inherent qualities which produce harm as well as good. Much commendation is due those who have subjugated this great force of nature to do man's bidding with such a comparatively few fires to its account. It must be remembered, however, that this result has only been obtained under the watchful eyes of inspectors, the combined efforts of manufacturers of devices and appliances to make their product fire-resistive and foolproof, as well as the subsequent care given to installation.

Contrast electricity with the simple match and cigar, both of which occupy such prominent positions as fire causes. Should we build up with one hand while we destroy with the other? Suitable remedial measures must be adopted to bring about a reduction of fire waste. The interpretations of statistics for relieving this problem, together with the impartial explanation of present practices, must be made, and information must be gathered and dispensed to the public in regular reports. It is undoubtedly the function of the federal government to do the task. There is no other medium which can effect uniform results. It is well known that at present one can obtain only a few pamphlets upon isolated phases of the problem from the bureaus of the government.

While present appropriations are doubtless inadequate to furnish a comprehensive solution of the problem of fire waste, it is believed that the available sources of information would serve to show what further constructive measures should be taken and how the program should be arranged. Why should not the electrical fraternity voice its protestations against the unequal fight to insure careful practices? FRANK W. GLADING.

West Philadelphia, Pa.

Resistance of Graphite

To the Editor of the ELECTRICAL WORLD:

SIR: In the April 23, 1921, issue of the ELECTRICAL WORLD the writer noticed a table giving the properties of heat-resistance materials in which the resistance of Acheson graphite material was given in comparison with carbon and other resistor materials.

We should like to call your attention to the fact that, according to our laboratory analyses of Acheson graphite, the solid electrode material has a specific resistance of approximately 0.00035 ohm per cubic inch, and solid electrode material made of retort carbon has a specific resistance of about 0.0015 ohm. As regards granular resistor, a standard grade of this material which we have on the market at the present time shows a resistance of 0.5 ohm per cubic inch when measured lengthwise in a trough, and carbon resistor of approximately the same degree of fineness measures 2.20 ohms per cubic inch resistance. The fineness of this material varies in particles from 0.099 in. in diameter to 0.254 in. in diameter.

You will note that the difference in relative resistance between carbon and Acheson graphite, according to the above tests, is considerably greater than the resistance given in the table in circular mils. We call this to your attention, thinking that there must have been some unusual conditions prevailing to give the slight differences in resistance shown by the data you published. S. L. WALWORTH,

Niagara Falls, N. Y. Sales Engineer.

Electric and Magnetic Variations and Disturbances

To the Editor of the ELECTRICAL WORLD:

SIR: Referring to the editorial comment in your issue of May 28 on "Sunspots, Auroras and Disturbances in Communication Circuits," permit me to direct the attention of your readers to a very interesting summary of present knowledge in this field published by Prof. S. Chapman in a recent number of the *Journal* of the (British) Institution of Electrical Engineers. There are few natural phenomena which have been as obstinate to the attacks of modern research as terrestrial electricity and magnetism. The reason doubtless lies in our inability to control the phenomena in experiment. Nevertheless, observation extended over a number of years, together with further knowledge of the nature of electricity and magnetism acquired in other fields, now permits a very much more definite statement as to the origin of electric and magnetic variations and disturbances on the earth's surface. The discovery of the electron and the consequent development of theory as to the structures of the atom have caused what has heretofore appeared somewhat remote speculation to be considerably more definite and plausible.

We are given to understand, in Professor Chapman's interesting review, that the quiet-day diurnal magnetic variations are due to horizontal motion of the upper layers of the earth's atmosphere. These layers are rendered electrically conducting by ionization due to gamma rays emitted by normal radioactive transformations in the sun. Motion in the earth's field causes secondary currents in the air layers which react on the earth's field, causing the disturbances in question. The motion of the layers is partly tidal, owing to the action of the moon, and partly thermal, owing to the sun. Magnetic storms are due to abnormal radioactivity in the sun, usually attendant upon sun spots. The aurora is supposedly due to the radioactivity mentioned and is supposed to have its origin in the "alpha" particles discharged during radioactivity. The motion of these particles is absorbed entirely in the upper layers of the atmosphere, causing the luminosity of the aurora and also causing conductivity. This proposal is of special interest, as it provides the conducting layer at high levels which has been looked upon by radio engineers as necessary to explain the bending of the waves of radio transmission so that they follow the surface of the earth. J. B. WHITEHEAD.

Johns Hopkins University,

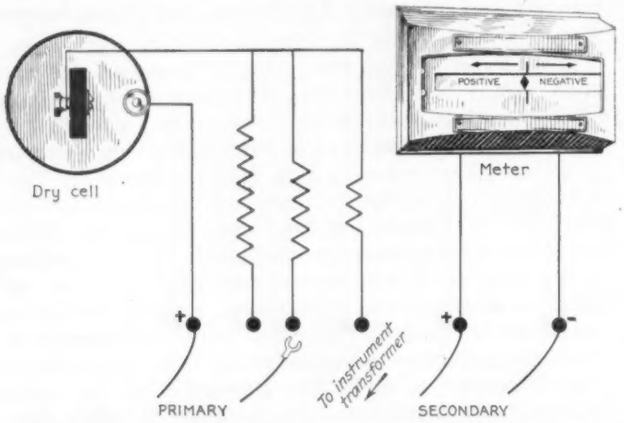
Baltimore, Md.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Testing Polarity of Instrument Transformers

TO FACILITATE testing of instrument transformers for polarity, the testing laboratory of the Connecticut Light & Power Company uses an indicator shown in the illustration mounted permanently on the test board. Such an indicator is more easily read than small



CONNECTIONS OF INDICATOR FOR SHOWING POLARITY OF INSTRUMENT TRANSFORMERS—NOTE HOW AMMETER IS MARKED FOR INDICATING POLARITY

portable instruments and has the added advantage of being out of the way. The indicator is made from an old switchboard direct-current ammeter with zero point shifted to the center and a new scale added. A dry cell mounted behind the board is connected through three resistances to four terminals on the front, from two of which flexible leads are brought to the primary side of the transformer to be tested. Two more terminals connect the indicator with the secondary side through flexible leads. Both terminals and leads are marked for polarity, while the word "negative" and the corresponding arrow on the meter scale are in red ink.

To test a transformer the secondary side is connected to the leads which go to the meter. Then the primary side of the transformer is connected to the battery posts. The transformer lead which is considered positive (usually painted black) is connected to the positive post of the meter and the negative lead is then touched to one of the negative posts. The pointer of the meter will move in one direction or the other. If it moves in the positive direction, the positive secondary transformer lead is the one connected to the positive post of the meter. If it moves in the negative direction, the negative transformer lead is connected to the positive meter post. Of course, when the primary lead is removed from the post the kick is in the reverse direction.

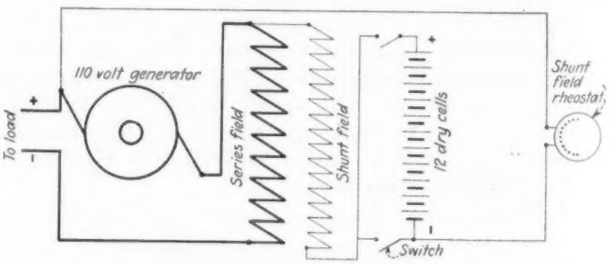
Resistance is necessary in series with the battery to limit the current through the transformer and to prevent too violent a kick of the indicator. By dividing the transformers into three classes and so marking the terminals, the proper connection may be made at once for any transformer without producing too great a deflection.

D. A. MCNULTY.

Waterbury, Conn.

Making Generator Voltage Build Up

DIFFICULTY was experienced in making a generator build up voltage after it was installed recently in a New England plant. By connecting dry cells in series with the shunt field as shown in the drawing the voltage was made to build up properly. The machine was a four-pole compound self-exciting generator of 25 kw. rating and of somewhat antiquated design which had been in storage for a number of years. At the time of its replacement by a more modern machine it had given satisfactory operation. Recently it was removed from storage to give emergency service. After being placed upon its foundation and belted to a steam engine it was found that the generator would not build up. A number of methods were tried to make it operate correctly. A test for residual magnetism proved that this still existed, and another test showed the poles to be of correct polarity. The armature leads were reversed and another try-out made, but without results. The brushes were lifted from the commutator and a 110-volt current was passed through the field windings. The original connections were then made, the brushes replaced and another try-out was had, but without results. The brushes were again raised and an exciting current was again passed through the field coils, but in the opposite direction from the first time. Again no satisfactory results were obtained. The generator was next connected as a separately excited



DRY CELLS EMPLOYED TO BUILD UP VOLTAGE IN GENERATOR

machine. By this method full voltage was obtained, and upon being loaded to about one-half capacity the generator operated satisfactorily.

However, when it was again connected as a self-exciting machine, voltage would not build up. The armature was next short-circuited by a 25-amp. fuse. The machine was brought up to full speed, but no voltage was generated for several minutes, when suddenly the machine began to build up, the fuse was blown, and full voltage obtained under no load. Load was applied

to the extent of about three-quarters of the capacity of the generator, and this load was carried satisfactorily. A second trial, however, was unsuccessful.

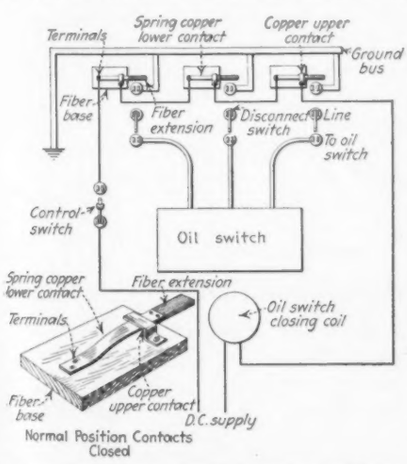
The final and successful method was tried after considerable more experimenting. A battery of twelve dry cells was connected in series with the shunt-field winding and rheostat, the other connections being those of a self-exciting generator. With these connections the machine immediately began to build up. Before full voltage was reached the battery was short-circuited and cut out of circuit, leaving the field circuit unbroken during the process of disconnecting the battery. The generator continued to build up when resistance was cut out of circuit by means of the field rheostat. Load was applied and carried satisfactorily. The generator was shut down and again started several times, each time giving satisfactory operation. Since then no trouble has been encountered while starting up.

It is assumed that, although the machine retained its residual magnetism, this was not in sufficient quantity to cause voltage to build up and that the dry cells, when connected in series with the shunt-field circuit, increased the magnetic flux sufficiently to make building up possible.

LEROY A. FRANCIS,
Chief Electrician.
Utica Steam Cotton Mills,
Utica, N. Y.

Accidental Closing of Oil Switch Prevented by Spring Contact Device

TO PREVENT a transmission-line oil switch from being closed while the line is connected to the ground bus through its disconnecting switches, an arrangement has been devised by the writer which is shown in the accompanying drawing. When the disconnecting switches are thrown to the ground bus the closing circuit of the remote-controlled oil switch is opened. This is accomplished by having the disconnecting switches bear upon the fiber extensions of the contact devices, thus breaking the control circuit. The contact device is a switch made with a spring strip for one of its terminals, and this spring normally rests against a small brass clip, both of the parts being mounted upon a fiber base. The spring strip has a fiber extension on which the disconnecting switch strikes, thus opening the circuit. Three of these contact switches are provided on a three-phase line and they are all wired in series with the control switch which closes the oil switch. Thus when even one of the disconnecting switch blades is thrown over to the ground bus the oil switch cannot be closed.



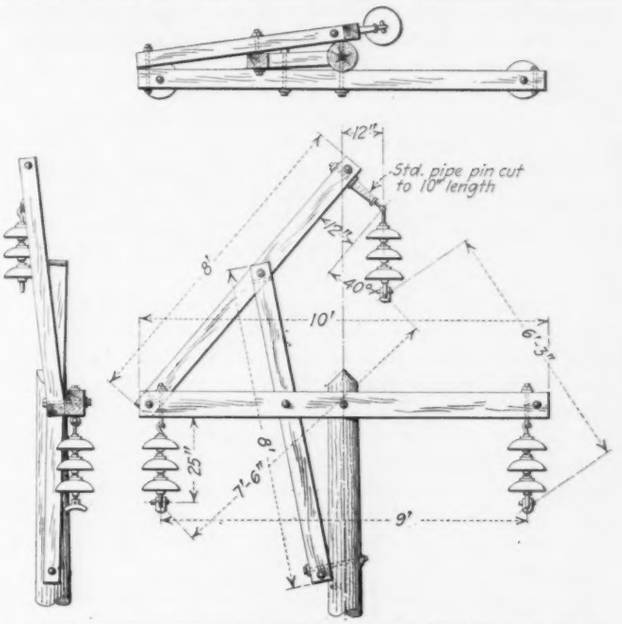
CONTROL TO OIL SWITCH OPENS WHEN DISCONNECTING SWITCH IS THROWN ONTO GROUND BUS

Of course, this contrivance will not prevent an oil switch at the other end of the transmission line from being closed on the line. Moreover, if the line is alive from the other end there is no arrangement to prevent the line from being thrown onto the ground bus through the disconnecting switches. Therefore the usual test should be made to determine whether the line is dead before it is thrown over to the ground bus.

Tuckahoe, N. Y. JOHN E. MCCARTHY.

Unusual Construction Greatly Reduces Pole-Line Costs

IN THE reconstruction and relocation of an old three-phase, 55,000-volt wood-pole transmission line conditions led to a departure from usual standards of construction on the Puget Sound Power & Light Company's Seattle division lines during 1920. This construction cost about $860 per mile of line excluding conductors, saving probably 19 per cent of the standard pin-type construction. The standard construction for lines of this character, at points where the right-of-way facilities prohibited wide base towers, has been 50-ft. single poles with 300-ft. spans and pin-type insulators screwed on malleable-iron pins arranged in a 7-ft. triangle. The high unit cost of some items of material and the local operating conditions led to the use of the suspension-insulator construction illustrated here. This special design is not necessarily adaptable to other conditions and does not possess many of the advantages of standard pin-type-insulator or double-pole-tower construction.



MODIFIED WISHBONE CONSTRUCTION FOR 55,000-VOLT LINE CARRIED ON SINGLE POLES

Pin-type insulators of the best design for this service cost in the vicinity of $7.25 each at the time of construction, making the total cost of fitting a three-phase pole top about $32. It seemed inadvisable to buy any more insulators than necessary at such prices. Suspension-insulator equipment cost approximately $45 placed per pole, but permitted considerably longer spans, thereby reducing the cost of the pole line and effecting an economy in the net total cost per mile.

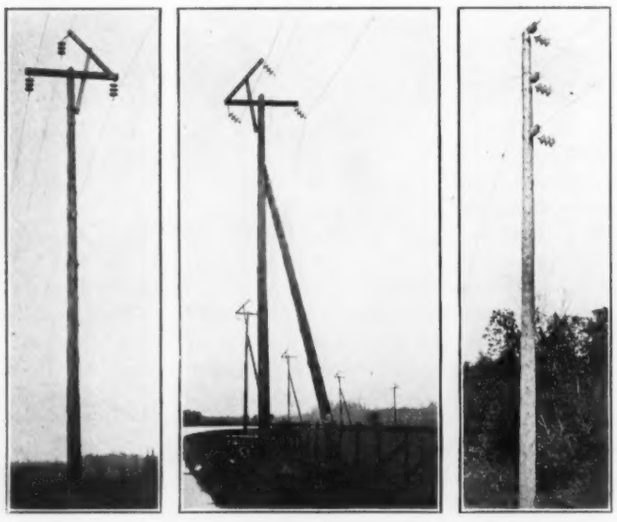
In the Puget Sound country tall trees are prevalent, and although all trees were cut down which, in falling, would reach the wires of this line, high winds sometimes break off small branches and carry them into the wires. Moreover, the blasting of stumps in clearing

land often carries fair-sized roots some distance. Snow is not unusual during winter in this climate, and at times it sticks to large wires and drops off in sections. Operating experience has shown that such conditions frequently result in making contact between two wires on long spans where the construction calls for suspension insulators with one wire placed above another. This made it very desirable to avoid a vertical arrangement of wires with suspension insulators, unless the spans were kept around 300 ft., in which case the economy of suspension-insulator construction would not have been obtained.

In the construction used cedar poles, 55 ft. in length, were employed having an average top diameter of 9 in. and 16 in. diameter at the ground level. Normal span lengths on tangents were made 475 ft. and could have been greater except for the soft ground at this locality. The conductors were 336,400-circ.mil (No. 4/0 copper equivalent), nineteen-strand, all-aluminum cables. The insulator strings on the section of line illustrated were made of three Jeffery-DeWitt disks, No. E-250, which provided some extra insulation for the line voltage of 55,000 volts with non-grounded neutral. On other lines Thomas, No. 1,054, link-type Hewlett insulators, three-disks to a string, and Ohio Brass, type B insulators, four disks to a string, were used.

The total cost of this construction averaged approximately $3,210 per mile, of which $860 represented the pole line erected and $2,350 was for the conductors strung in. Under similar conditions the standard 300-ft. span pole line with pin-type insulators costs about $1,065 per mile fitted ready for conductors. Linemen were paid $7 per day and groundmen $5.25 per day of eight hours. About 80 per cent of the line was along paved road in a valley and the poles were rock-tamped. The remainder was across rough country, but in more solid soil.

Stress computations were made of the loading of the conductors and supports, and the construction was designed to comply with the Bureau of Standards' requirements. Dynamometer tests were made to check twisting strain which would exist under all probable conditions.



ECONOMICAL CONSTRUCTION FOR 55,000-VOLT LINE ON NARROW RIGHT-OF-WAY

Left—Spans on tangent are 475 ft. long. Long turns are made as shown in the center. Right—No arms are used at sharp corners.

The arrangement of the cross-arms is a modification of the familiar wishbone construction and avoids a vertical arrangement of the wires. The cross-arms are of the same proportionate strength as on ordinary construction. The two small crossarms are alike and interchangeable and bolt holes are bored at the mill, so that the framing is simplified and cannot be placed wrong. The fitting which supports the top wire was made from obsolete 2½-in. malleable-iron pipe pins and is merely a spacer for the eye-bolt. It holds the insulator out from the cross-arm far enough for clearance. Lee pins could have been used for this purpose in place of the pipe pins.

The sag placed in the conductors was computed for the safe working load of 8 lb. wind and ½ in. of ice at 0 deg. Fahr. The sag was about 12 ft. in the average spans. The same loading with wind normal to the line stresses the pole cedar to an extreme fiber stress of 2,500 lb. per square inch. Under conditions of heavy loading on one span and none on adjoining span the wire in the loaded span will reach an extreme position about 25 ft. from the ground. With the triangular arrangement the probability of contact between phase wires under such unequal loading is much reduced.

M. T. CRAWFORD,
Superintendent of Distribution.
Puget Sound Power & Light Company,
Seattle, Wash.

Waterwheel Pit Flooded When It Became Sealed with Water

A RATHER unusual case of trouble occurred in one of the smaller hydro-electric generating stations of the Southern California Edison Company caused by the outlet from one of the waterwheel pits becoming sealed by water. As soon as the seal became effective the outgoing water carried with it air from within the pit and wheel casing and caused the level of the water in the pit to rise.

When the water rose sufficiently high in the wheel pit the buckets struck it and the output of the generator was greatly reduced. Upon locating the cause the remedy was simple. A small hole was drilled in the casing, thus permitting the outside air to enter the casing and allow the water to recede in the wheel pit.

J. W. ANDREE,
Assistant Superintendent of Generation.
Southern California Edison Company,
Los Angeles, Cal.

Convenient Marking for Instrument Leads

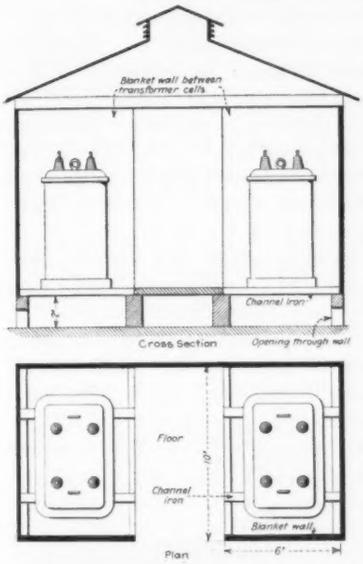
THE metal tags which are commonly used to mark control wires where they enter and leave conduits very often become lost or interchanged, particularly if the wires are cut and spliced. In order to prevent this an improved system of marking has been adopted in a substation recently constructed in San Francisco, Cal. Near the entrance to the conduit a number was stamped over each of the wires on a metal plate placed on top of a cleat which held the wires to the board. Similar numbers were placed over connecting wires at each end of the conduits, thus giving a positive and reliable marking. This information was contributed by J. E. Woodbridge, engineer for Ford, Bacon & Davis.

FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Air Spaces Under Transformer Reduce Operating Temperature



SEMI-CHIMNEY CONSTRUCTION OF BUILDING LOWERS TRANSFORMER TEMPERATURES

A MARKED decrease in operating temperature of some 625-kva., three-phase, 6,600/440-volt naturally cooled transformers installed in a substation of the Miami (Ariz.) Copper Company was effected by constructing the building so that a strong draft around the transformers resulted. As shown in the cut, the transformers rest on channel irons with an air duct beneath. Cool air enters the building through the opening into this duct and after passing up along the transformers leaves through louvers in the roof. Blanket walls are placed between the several transformers as shown to maintain the chimney effect.

Miami Copper Company, Miami, Ariz. — J. J. LUCHESSA, Chief Electrician.

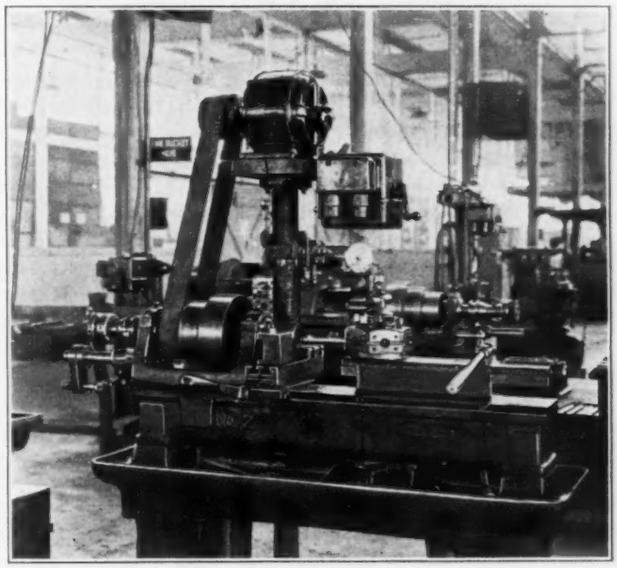
Locating a Very Small Leak in Storage-Battery Jar

A CASE in which a leak in the jar of a storage battery was very difficult to find recently came to the writer's attention. This leak, small as it was, caused the battery to give out when the vehicle on which it was installed had made only about half its normal number of miles. When it was found that this vehicle would not run it was thought at first there was some internal trouble in the battery, which was therefore tested for a ground by touching one end of a wire to the frame and the other end to one battery terminal. On withdrawing the wire a spark was produced which showed that one cell was grounded to the frame of the vehicle. The leaky cell, however, could not be found. Therefore the cells were removed from the vehicle, wiped perfectly dry, set down on a piece of brown paper and left over night. In the morning it was discovered that the paper underneath one of the cells was wet with acid. Still, however, the leak could not be discovered by inspecting with the eye. Therefore, in order to find just where the leak was, the cell was lowered into a bucket containing water which came just below the level of the top of the jar. A lamp was then connected in series with two test wires from a 110-volt line. This was done by dipping one lead from the line into the water in the cell and the other lead into the water outside the cell. When this was done the lamp lighted. When the cell was raised the lamp continued to light until the bottom of the cell was removed from the water. The cell was consequently wiped dry, and only the bottom of the jar was put in the water while the same test was made with the lamp. The lamp burned as before, showing that the leak was at the bottom of the jar. If the leak had been near the top of the jar, the lamp would not burn until the jar was lowered down so that the water covered the leak. By looking carefully a very small leak was found at one of the bottom corners. This leak was probably due to imperfect molding.

J. H. HENDERSON, Battery-Repair Foreman.
American Railway Express Company, New York, N. Y.

Convenient Adaptation of Motor Drive to Screw Machine

THE adaptability of individual motor drive for machine tools is well illustrated by the conversion from a group-driven installation of the East Springfield (Mass.) factory of the Westinghouse Electric & Manufacturing Company. In fitting up this plant after its conversion from group drive for producing rifles for war service individual motor drives have been chosen



INDIVIDUAL MOTOR MOUNTED FOR DRIVING SCREW MACHINE

generally and a great variety of motor mountings were necessary. The accompanying photograph is a Garvin No. 2 hand-screw machine belt-driven by a 1-hp., 440-volt induction motor supported by a 3-in. pipe. The motor is mounted directly on a ¾-in. x 8½-in. x 10¾-in.

wooden base bolted to a pipe flange at the top of the pipe which is set in the floor. The starting switch is attached to the base by ¼-in. x 1-in. iron straps. The arrangement carries both motor and starting switch above the machine and behind it, keeping the switch, however, within easy reach of the operator at his post in front of the machine. The belt is of sufficient length for smooth running.

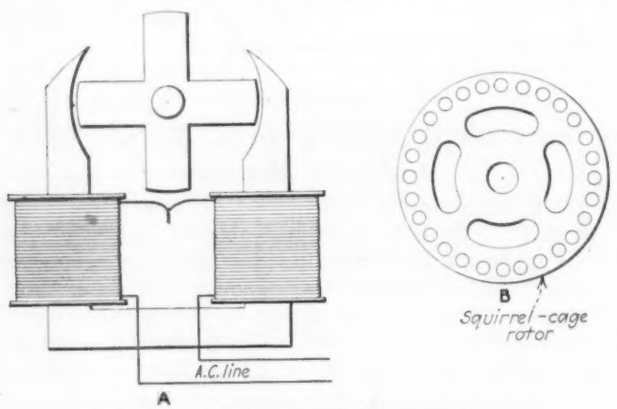
FIELD EDITOR ELECTRICAL WORLD.

Boston, Mass.

Small Motors Made to Run at Synchronous Speed

A SMALL motor that will run at synchronous speed is often required for various apparatus such as slip-indicating machines, timing devices, etc. Such a motor may consist of a rotor having two or four bars of iron revolving between the poles of a laminated horseshoe magnet excited by alternating current as shown in the drawing at *A*. A motor of this kind is very simple, but it must be brought nearly to synchronous speed by hand or other means before connecting to the line, and this is an objection to its use.

A motor which is self-starting may be made from any



TWO TYPES OF SMALL SYNCHRONOUS MOTORS

small squirrel-cage induction motor by cutting openings in the rotor core to correspond with the number of stator poles as shown at *B*. There are generally four poles on small motors. Such a motor will start in an instant and run at synchronous speed after connection to the line. However, it will not hold in step if heavily loaded. If the openings are the proper distance below the squirrel-cage winding, the efficiency of the motor may not be changed at all.

There are certain makes of small squirrel-cage induction motors on the market that were found by experiment to run at synchronous speed, carrying about one-third of their rated load before starting to slip at all, but on heavier load they drop out of synchronism. The rotors of these motors have four holes through the core as shown at *B*, and the stator is wound for four poles, single-phase, with a teaser winding for starting which is ideal for light work. Any two-phase or three-phase motor would work in the same way with a similar rotor.

The magnetic reluctance varies with the position of the rotor in the magnetic field owing to the openings in the rotor. The rotor therefore tends to remain in a position giving the least reluctance or with the spokes directly under the poles of the stator, allowing the magnetism to divide around the openings.

East Orange, N. J. PHILIP G. BERNHOLZ.

Brush and Commutator Troubles Prevented by Proper Care

NOT only should great care be given to brushes when first installed but they should also receive careful attention throughout their life. Brushes, holders and commutator should be cleaned thoroughly and regularly, so that it will be certain that each brush shall have free play in its box and that the pressure arm also shall have free movement. Such attention to detail may mean the difference between good and poor brush operation. Usually when brushes are operating poorly they are shouldered with the entire blame irrespective of conditions. There are conditions, however, under which any brush will operate poorly. One very common fault is copper picking, and usually this is caused by other reasons than improper brushes. Often this fault is exceedingly difficult to correct. Occasionally brushes pick copper immediately after being first installed, while their surfaces are still freshly sandpapered and the commutator surface is raw. Under these circumstances brushes pick up copper that is liberated by mechanical abrasion. If this be the case, the trouble can be overcome by carefully wiping off each brush from time to time until the contact surfaces are polished. However, in most instances copper-picking is caused by circulating currents in the faces of the brushes. Machines with interpoles or pole-face windings are much less liable to copper picking than the non-interpole machines. On the latter type of machine a better brush position for the required load conditions may effect an improvement in this fault. Often poorly sanded brushes, with resultant small areas of contact, cause undue circulating currents to flow, resulting in extreme local heating, which in turn burns off particles of copper from the commutator bars, and these particles are caught by the brush surfaces. Sometimes under certain conditions brushes of only one polarity are affected—usually the positive brushes on a generator or negative brushes on a motor; that is, copper is carried along with current flow from copper to carbon. After all other efforts fail an improvement may be made by changing the grade of the brushes, this change having the effect of altering the amount of circulating current or acting as a damper to the passing of copper particles from commutator to brush.

Ridging or grooving of commutators is another fault that is distressing to the operator who takes pride in keeping his machines in the best condition. The location of the brushes on the commutator plays a great part in correcting this fault. The method of staggering brushes around the commutator which gives the best results is to have the staggering done in pairs of studs rather than alternately. The latter method permits the positive brushes to track on one part of the commutator while the negative track on another. It is found that usually the negative brushes on a motor wear the commutator much more rapidly than the positive; hence if all negative brushes are permitted to track each other, grooves will form, leaving ridges under the positive brushes. Excessive grooving may be caused by a too abrasive brush, by too much spring tension, which should be only great enough to keep intimate contact between brush and commutator, or by improper brush position or commutating-pole adjustment permitting undue circulating currents to be present in the face of the brush, causing excessive local heating which burns away the copper.

Frequently operators apply lubricant to the commutator in an endeavor to stop the grooving action. This practice is not advisable as the lubricant is liable to gum on the commutator, causing varying contact drop and position of the brush. For the same reasons the use of impregnated brushes is not recommended.

Chattering of brushes is another distressing fault, which is caused by using an improper grade of brush, by brushes operating at the wrong angle, by the commutator surface being uneven or out of "true," or by high mica. Trailing brushes work best at 15 deg. or less, while leading brushes, reaction type, should have an angle between 30 deg. and 40 deg. (The angles as here used are the degrees of tilt from the radial position.) It will not be necessary to elaborate on uneven or out-of-true commutator surfaces as all are familiar with this phase of trouble. However, high mica may be the cause of trouble when least expected. Even after a commutator is newly turned down, the mica may be slightly high because the machinist has not had the proper edge on the turning tool and consequently the copper has been cut away more than the mica. A good stoning or strenuous attack with carborundum cloth when the machine is cold will be necessary to take down the mica. Chattering is often present on a commutator having a surface speed too high for the particular grade of brush used, hence it is urged that operators keep within the limits of speed as outlined by the brush manufacturers.

A. L. HEATH,
Morganite Brush Company, Engineer.
New York, N. Y.

Incorrect Spacing Wears Brushes

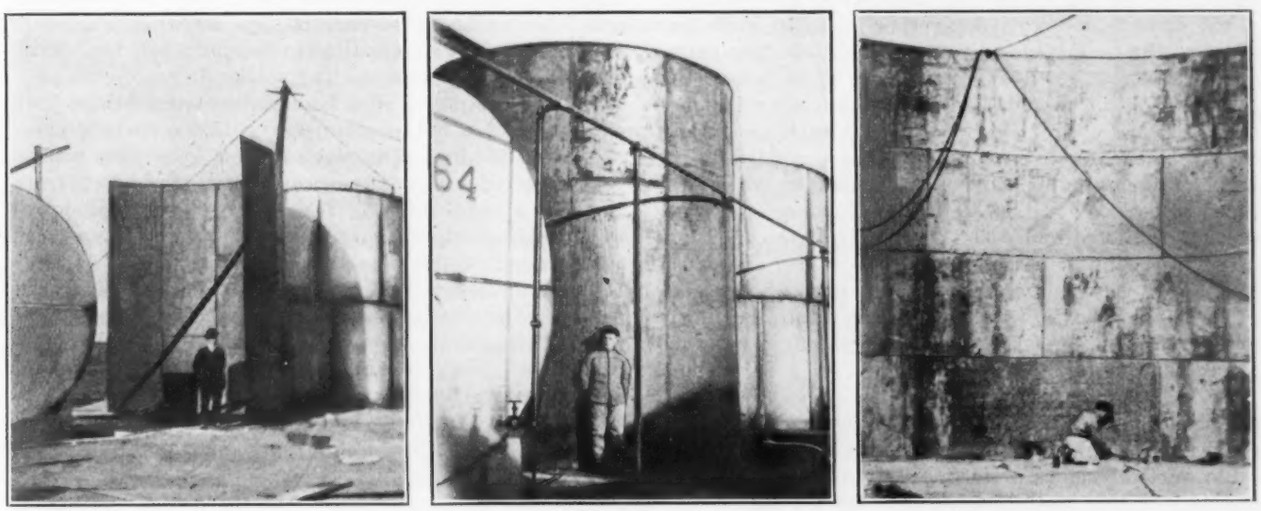
BRUSH spacing on a motor is more important than is often realized. If one brush is a little ahead of its correct position and another brush on some stud of the same polarity is a little behind its correct position, an unequal voltage is set up which may result in high circulating or short-circuit currents between these studs. This will result in abnormal brush and commutator wear.

A discussion at a meeting of the Iron and Steel Electrical Engineers brought up this point.

Electrically Welded Tanks Show Many Advantages Over Riveted Ones

ALTHOUGH the general method of building oil tanks by electric welding is similar to that of other tank work, there are certain advantages over the riveted construction which are of particular interest. For instance, the reduction of leakage losses is very important. One representative oil company has estimated its average yearly leakage loss at 5 per cent of the contents of storage tanks with a higher percentage for the lighter grades and a lower percentage for the heavier grades of oil. In the welded tank there is no danger of wind pressure, filling and emptying of tanks or temperature changes causing leaks as is often found to be the case in riveted construction.

In order to make a tank riveting job accessible, it is necessary to rivet the bottom and first course on horses and then lower into final position on the foundation. Very frequently the strains set up by lowering cause leaks in this portion of the tanks which are not discovered. The welded tank, on the other hand, is welded in the position in which it is to remain.



ARC WELDING HAS GIVEN EXCELLENT RESULTS IN BUILDING OIL-STORAGE TANKS

Tanks may be erected with vertical seams only or built in courses with horizontal seams. In some cases the plates are welded together while flat on the ground and the two halves of the tank bent to shape as shown in the left-hand view.

The life of a welded tank must be estimated as being at least twice that of a riveted tank, for the reason that the skin of the plate is not broken as is the case where riveting is done. Less painting is required as there is no leakage to cause discoloration, which often occurs with riveted joints. In refineries using tanks painted white the reduction in painting expense is considerable. As the roof section in a welded tank is gas-tight there is a reduction in evaporation losses, and at the same time insurance premiums are lower than for an oil tank which is not gas-proof.

From a construction standpoint the work of erecting a welded tank is much simpler than the corresponding work for a riveted type. In fabricating materials for the riveted tank it is usually necessary to make templates, mark, punch and ream the plates, and it is also important that the edges of the plates be "faired" and that the size of the sheets be accurate. In welded construction it is possible to eliminate the rivet holes, butt straps, bosom pieces, gusset plates, angles and fairing of

plates and to also reduce the amount of lap of the plates. With a few exceptions it is unnecessary to fabricate the plates. Inasmuch as the welded lap joints are fully as strong as or stronger than the plates themselves, it is possible to lighten the plates by at least 15 per cent and at the same time have a structure which is from 10 to 20 per cent stronger than the present standard of riveted tanks.

A 500-barrel tank was recently built the welding of which deviates somewhat from ordinary procedure and shows what may be accomplished with this method. The dimensions of the tank are as follows: Diameter, 16 ft.; height, 16 ft.; five 5-lb. plates of blue sheet steel (No. 10 gage), size 4 ft. x 11 ft. for the shell.

The bottom plates were laid out flat on the foundation and welded from one side. After this was concluded the bottom was turned over and welded from the other side. The shell was built up in a method differing somewhat from ordinary procedure. Instead of being built in several courses it was built in one single course, which meant that vertical seams were used in welding the shell together. The plates of the shell were first laid out on the ground and welded together so as to make two halves of the tank. One-half of the shell was then raised by means of a gin pole and one corner of it tack-welded to the bottom. The ends of a turnbuckle were fastened to the outside end of this half of the shell about half way up by means of clips that had been welded to the shell. By tightening this turnbuckle the shell was forced into place and tack-welded as it came into proper position on the bottom. The other half of the shell was raised in a similar manner and tack-welded into position. Naturally this left the upper part of the shell out of shape, and this was taken care of by looping a cable around the upper part and by tightening the shell to force it together.

A 6-in. I-beam was used to force the edges of the shell into position for welding. After the vertical seams had been welded outside, the I-beams were removed and the inside vertical seams welded. Bolt holes which were necessary in this method were then welded up.

A 2-in. x 2-in. x ¼-in. angle iron was welded around the top of the shell heel and toe. The roof was welded on this in three courses. The ends of the center course were split in the middle and a V-piece was cut out of each end. A 12-in. block was put under the middle of the center course to give the roof the proper pitch, and in this position the slits were closed and welded up. This course was then put in place and welded to the top angle, and the other courses were lapped to the center course and welded to it at the top angle. There was no frame used under the roof.

The tank on completion was filled with kerosene and found to be absolutely tight. It has been in constant use for seven months. This method has also been successfully used in a number of other cases.

The welding was done with electrodes of 0.134-in. diameter using a current value of about 125 amp. The average speed of down-hand welding was 10 ft. per hour, while the average speed of vertical welding was 5 ft. per hour.

In welding a 5,000-barrel tank the procedure was more nearly comparable to that found in riveting practice. That is, each course was bolted together before being welded, using bolts about every 3 ft. The dimensions of this tank were as follows: Diameter, 43 ft.; height, 20 ft.; bottom of 5/16-in. plate, first course of ¼-in. plate, second course of 5/16-in. plate, third course of 11/32-in. plate, fourth course of 3/16-in. plate, and the roof of 1/8-in. plate. The size of the shell plate was 5 ft. x 14 ft. A 1½-in. lap was used throughout welded from one side in the top and bottom and from both sides in the shell, the heavier weld being on the outside and in down-hand position.

A 2-in. x 2-in. x ¼-in. angle iron was laid on the bottom along the outside edge, leaving a ¾-in. space between the angle and outside edge of the bottom. This bottom flange of the angle was then welded to the bottom of the tank. The first course was set on the bottom and backed against the angle and welded to the bottom all the way around the sides by a ½-in. weld. The angle was welded to this course from the inside by a ¼-in. weld. A 2-in. lap was used between courses, and the outside welds were made for strength while the inside welds were made to seal the joints between the two plates. The plates were scarfed where three plates came together. The joints were welded in the ordinary way. The top angle, 2 in. x 2 in. x ¼ in., was welded heel and toe all the way around. The roof was of the ordinary type of steel roof with a center and radio plate. The angles and I-beams and roof construction were all welded in the simplest way according to common practice developed in constructural welding work.

In this case plates of 5/16 in. and over were welded with electrodes of 0.164-in. diameter, using a current value of about 145 amp. The plates under 5/16-in. were welded with electrodes of 0.134-in. diameter, using a current value of about 125 amp. The average speed for down-hand welding was 8 ft. per hour, while the average speed for vertical welding was 4 ft. per hour.

From the amount of work done to date it has been definitely established that the same procedure can be followed in construction of tanks of any size that may be desired. Various kinds of acid tanks, agitators, etc., are being successfully welded with the electric method.

Electric Arc Welding Company of America, New York, N. Y.

WILLIAM SCHENSTROM, Consulting Engineer.

Judging Temperature of Motor by Feeling with Hand

VERY often the user of an electric motor will wrongly conclude that it is operating at too high a temperature after testing it by feeling with the bare hand. However, it is known to those who are familiar with heat tests that to the touch of an inexperienced hand a rise of 40 deg. C. over the temperature of the average shop is exceedingly disagreeable, and with a 50 deg. C. rise the sensation is unendurable for even a few seconds. On account of the fact that the operator cannot comfortably bear these temperatures, he believes that the motor is overheating. Nor is the average operator convinced when a thermometer applied in the usual way shows that the operating temperature is well under the rating of the machine.

A check that usually finds favor under such circumstances is to heat a small quantity of water, when such may be readily done, to the temperature recorded on the machine and let the doubter test with his fingers. He will usually find that the water is uncomfortably warm although the temperature is still lower than that for which the motor is rated. Since there is nothing mysterious about such a demonstration, it will go far toward easing the mind of the operator.

WILLIAM THOMSON.
New York City.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

The Interest of the Public in Utility Development

James A. Perry Discusses the Handicap Caused by Lack of Information and Deplores Unfounded Political Agitation

ONE of the outstanding addresses delivered at the convention of the National Electric Light Association in Chicago last week was the one made by James A. Perry, president National Association of Railway and Utility Commissioners, Atlanta, Ga., on the interest the public should take in the development of public utilities. He said in part:

"One of the great handicaps in the operation of a successful public utility is lack of information and duty on the part of the public served by the utilities. If the public and the press of the country would only approach such a subject with the facts in mind that there are 1,450,000 private citizens in this country with their savings invested in the securities of electric light and power companies, that the insurance companies of our country have over $300,000,000 in the same securities, this representing indirectly the savings of the poorer class of people of the country, and that the 27,000,000 depositors in the 29,000 banks in the United States have a direct interest in such utilities, because of the fact that their money in the sum of $1,700,000,000 is invested in such securities—an amount which in thousands of cases represents the inheritance and savings of widows and orphans—I believe they would be less inclined to embark on a course that at times means bankruptcy to the business, a hardship on the public it serves and heavy losses to the investing public.

"The public is not entirely at fault for accepting as true reckless and untruthful statements of irresponsible individuals concerning the affairs of public utilities. At times we see newspapers playing up such statements, regardless of the facts or source from which they come. Such a campaign of misrepresentation should never be allowed to go unchallenged. The facts should be given to the public, and in most instances they will be readily accepted.

"In return for good service and reasonable rates for such service the public has a vital interest in such rates being maintained as will justify the investing public in furnishing sufficient money to guarantee speedy development. In the absence of such development the public must continue to pay a higher rate for a substitute service less efficient and giving less satisfaction.

"I know of no greater curse to the business interest of a community than has arisen where agitators have been allowed without answer to disseminate alleged facts in derogation of practical, legitimate utility development. I would say to the public, get our utility development as we may, the fact remains that we are going to pay a reasonable return on the fair value of the property used in giving the service—it makes no difference whether municipally owned, 'home-ruled' or privately owned and regulated. Dating from some two years ago, there is no question in my mind that many regulatory commissions throughout the country made the common mistake of holding light and power, gas and street railway companies to rates that were too low, hoping that the immediate future would amply justify the rates prescribed. This hoped-for condition was not realized. The experience was just the opposite of what we had expected to see.

"The law by which regulatory commissions are governed requires them to prescribe just and reasonable rates, and the courts throughout the country have declared that a just and reasonable rate is one that with competent management will afford the utility a reasonable return upon the fair value of its property used in the public service. Just compensation for the use of private property by the public is a constitutional right which cannot be denied.

"It seems to me that we have in the present-day hostile attitude of the public toward utilities a feeling somewhat similar to that which we recall existed toward railroads for years before government control—so much so that if there does not come into play a better feeling between the public and the utilities, and that right away, we cannot hope for any less expensive experience in this instance than we have had with railroads.

Universal Opposition of City Officials to Rate Increases

"At the present time, in many instances, a utility files an application with the regulatory board of the state in which it operates. This done, a copy of such application is served on the municipality affected by the change proposed. It makes no difference what the relief asked for may be, the mayor and council meet and promptly vote to instruct the city attorney to oppose the granting of the relief sought. No investigation is made as to the justice of the relief petitioned for, but the city attorney is directed to oppose it, not to investigate and ascertain the truth as information for the mayor and council before action is taken one way or the other.

"We seldom hear of a municipality under such circumstances making an investigation and ascertaining whether there is any merit in the claim of the utility company. Investigations are seldom made, little information is had, and seemingly none is desired.

"This, of course, is an unfortunate situation. In the end it will be overcome, but not without loss to the utility and the public while such a condition prevails. Competitive business had its day and failure. Regulated monopolies are now on trial. The public is still

paying 100 per cent more for some merchandise than the same articles sold for four and five years ago, but the thought of paying a 50 per cent increase in utility rates as compared with prices for such service three and four years ago meets with scant sympathy.

"Capitalization of years ago as an argument against increases in rates at the present time is taken seriously by no one who knows anything about the subject. Yet, in spite of the deception in the argument, we hear it stated that present increases are necessary to pay dividends on watered stock. Not a word of truth in the statement, but when sponsored by one who has no regard for the correctness of his statements you will find that here and there it is accepted as true. The regulatory commissions throughout the country, sustained by the reviewing courts, are in accord that the fair value of the property devoted to serving the public shall be considered in prescribing rates for utility service. Little or no consideration is ever given to capitalization. You never hear of a company basing an application for rates on the amount of capitalization. There is no justification in the position that old capitalization schemes are relevant in considering what is a reasonable rate of return on the fair value of the property used and useful.

"The public has a special interest in the expansion of utilities because a city can never grow faster or extend further than her utilities reach. The utilities of a community are the greatest developers any city ever had. No city can build beyond the lines of her street railroads, and this is true to a degree in comparison with the area covered by gas mains.

"Few sections of this country can finance utility development of any kind from local capital. The financial necessities of the development, therefore, carry us to foreign fields for money. Is there a man anywhere, regardless of his business interest, with surplus money for utility investments, who is going to send his money into communities where there exists a citizenry hostile to foreign capital for such investments? Even worse, will such a man send his money into a state for such investments where the state regulatory board refuses rates that will earn even less than the lawfully prescribed rate of interest as a return for utility service? Will such money find its way into a state where condemnation of such property is the talk of the day?

"The public has an interest in seeing that such conditions do not exist; it has an interest greater than the selfish interest of the few who would stop the utility development of every community while their political ambitions are satisfied or a personal grouch is assuaged. It is a sad picture to see a community of inflamed citizens following the leadership of one man, or even several men, in an effort to handicap or destroy a local utility, all because of a personal grudge on the part of the few self-styled leaders. This kind of thing has got to stop in this country, otherwise the public will pay the high price of stagnation in such growth with a breaking down of the present service rendered.

"I cannot believe the public will stand for a reactionary program that will certainly carry us back to crude methods with less service and at higher rates. We may halt, temporarily, here and there over the country, but in the end the production of electric power, as well as other utility services, is going to be carried on in a wholesale manner. Any other method is squarely opposed to the very fiber of our people and form of government."

Promoting Good Will by "Department of Greater Service"

THE "department of greater service" established by a Western company to create and nourish good public relations, as recounted in the ELECTRICAL WORLD for May 28, page 1230, by S. M. Kennedy, vice-president of the Southern California Edison Company, makes use of a folded card bearing on the inside the inscription here reproduced, and the name of the company and that of a special representative on the outside. When this representative calls upon any consumer to ascertain whether the company's service is satisfactory in every way one of these cards is left behind as a record of the company's attitude.

GREATER SERVICE

BELIEVING THAT TO SERVE

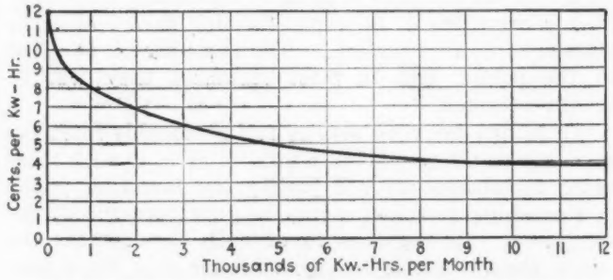
is both an obligation and an opportunity, the —— —— Power Company maintains that no consumer is properly served unless there exists that fine and intimate relationship inspired by mutual confidence.

Our unwritten agreement with every consumer provides that he may call upon us at any time for advice, suggestion or counsel in matters electrical. No problem is too large for our organization to handle and no detail too small to receive our most careful attention.

We will welcome every opportunity to extend our usefulness and to have you fully understand what we mean by GREATER SERVICE.

Small Company's Power Rates Consistent with Use

A SMALL central station in Massachusetts had fifty power customers in February, 1921, and an analysis of the bills rendered showed a symmetrical decrease in the price of energy per kilowatt-hour as the use increased. The fifty customers consumed 91,220 kw.-hr. in the month at a total billed cost of $4,006.85, making 4.4 cents per kilowatt-hour the over-all price. Twenty of the customers were billed the minimum charges only, on account of using but 3,164 kw.-hr., and the cost of this service was $542.25, or 17.1 cents per kilowatt-hour. The remaining customers used 88,056 kw.-hr. at a total price of $3,464.60, or 3.93 cents per kilowatt-hour. It was evident, as shown in the accompanying curve, that power customers who used even a moderate amount of energy were much better off per unit than those who used but little, and the figures showed that the burdens of "overhead" on the power user and central station make regular production extremely desirable economically.



RELATIVE PRICE PER KW.-HR. TO CONSUMPTION OF ENERGY

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Motors, Generators and Transformers

Heat Losses in the Conductors of Alternating-Current Machines.—WALDO V. LYON.—The solution for the distribution of alternating current within conductors in high-capacity alternating-current generators has been worked out for a number of cases. Heretofore investigators have used trigonometric and hyperbolic functions of real angles in these problems. In the present investigation hyperbolic functions of complex angles are used and the results are accomplished, it is said, with much less effort.—*Journal A. I. E. E.*, May, 1921.

Suppression of the Third Harmonic in Three-Phase Transformers.—H. PISTOYE.—Magnetic flux set up in the steel tanks of transformers suppresses to a certain extent a third harmonic frequency, which is liable to appear in three-phase Y-Y types. But this suppression is accompanied by increased iron losses of the transformer. The author recommends and has actually built transformers with several tertiary windings embracing all three legs of a three-phase core-type transformer. With this arrangement the dangerous third harmonic has been successfully eliminated in Y-Y connected three-phase transformers with no additional losses.—*Revue Générale de l'Electricité*, April 23, 1921.

Generation, Transmission and Distribution

Electricity Supply and Housing Schemes.—A series of papers in which this and allied subjects are discussed under the following headings: "Electricity Supply and Housing Schemes" (some practical problems), by W. F. T. Pinkney; "The Supply of Electricity to Housing Colonies," by E. E. Hoadley; "The Place of Electricity in Town Planning," by C. B. Purdom; "Selling Electrical Energy in Bulk to the Domestic Consumer," by H. Richardson, and "Some Aspects of Domestic Lighting," by J. S. Dow.—London *Electrician*, April 8, 1921.

How to Protect Pulverized-Coal Plants from Dust Explosions and Fires.—A vacuum system should remove the dust from the air in the building. Excessive heat should be avoided in drying, as it might cause fires in storage bins. Air supplied for burning coal should be kept from forcing its way into the coal-supply line on account of the danger of its carrying sparks with it.—*Coal Age*, April 28, 1921.

Peat Power Plants in Germany.—An account of the results obtained from burning peat at the Wiesmoor plant, which was the first power plant erected in Germany for furnishing electrical energy from peat. Other proposed plants which have been suggested following the success of the Wiesmoor plant are described.—*London Engineer*, April 22, 1921.

Modern Practice with Steam Superheaters and Their Fields of Use.—H. B. OATLEY.—The writer discusses the design, including a detailed study of types of superheater installation, application and use. Tables of performance with saturated and superheated steam are given.—*Journal of Engineering Institute of Canada*, May, 1921.

Submarine Power Cables.—F. A. WESTBROOK.—Submarine power cables are made with large conductors and heavy insulation for voltages up to 30,000 and are consequently bulky, stiff and difficult to handle. They have therefore been limited to lengths of a few miles, the longest cable of this kind now in service in the world being about 3.5 miles (5.6 km.). The manufacture of such cables and methods of splicing are dealt with more particularly.—*Bulletin of N. E. L. A.*, April, 1921.

Utilization of Hydraulic Energy for Electrification of Steam Boilers for Heating Purposes.—P. BERGEON.—About 20 per cent of the total coal consumption of France is used under steam boilers for industrial heating. The efficiency of the coal-heated boiler, even in large units and modern plants, is only about 60 per cent, whereas an electrically heated boiler operates at about 95 per cent efficiency. Over-all-loss diagrams are shown which demonstrate that (1) the efficiency of the transformation of coal into steam is about 60 per cent, (2) the efficiency of the transformation of coal into mechanical energy is about 11 per cent, (3) the efficiency of the transformation of hydraulic energy into steam by electrically heated boilers is about 66 per cent, (4) the efficiency of the transformation of hydraulic energy into mechanical energy is about 62½ per cent. Technically the electric boiler has been brought to a very high degree of perfection. Any alternating-current voltage up to 10,000 may be used directly. Tests showed a consumption of 4½ kw.-hr. to be equivalent to 1 kg. of 7,500-B.t.u. coal. The author shows that if only one-half of the existing boilers generating steam for heating purposes in three French provinces were electrified, taking energy from an ample hydraulic supply, an annual coal saving of 180,000 tons would be realized.—*Revue Générale de l'Electricité*, April 23, 1921.

Traction

Diesel-Electric Motor Cars.—LUCIEN PAHIN.—The article is an interesting and detailed description of the four types of Diesel-electric motor cars built by the Allmänna Svenska Elektriska Aktiebolaget and operated since 1913 on different Swedish lines with marked success. The four standard types comprise a 75-hp. car and a 120-hp. car, each for both standard and narrow gage (1,435 mm. and 891 mm.). These are the main data for the standard-gage 75-hp. car: It accommodates fifty-one seated passengers, one baggage compartment, a lavatory, the engineer and the conductor, and weighs complete, ready for service, 29,300 kg. The Diesel six-cylinder engine is rated at 75 hp., 550 r.p.m., and is capable of a 20 per cent overload, consuming 200 grams of heavy oil per horsepower. The engine is started from a storage battery, which also illuminates the car. The air compressor, water pump and lubri-

cating-oil pump are driven from the main shaft. The cooling water of the cylinders is circulated through a system of cooling coils on top of the cap, in winter through radiators under the seats. The generator is direct-current, eight-pole (and commutating poles) dynamo, flexibly coupled to the engine. Its shaft runs in ball bearings. The speed of the two driving motors is changed very economically by a wide voltage regulation of the generator. During the normal run the generator operates as a plain shunt machine; at the starting it runs as a series motor. A complete train, weighing 40 tons, attains on the level a speed of 53 km. per hour; the motor car alone has run as fast as 80 km. per hour. At every station the Diesel motor is stopped. The first controller position corresponds to the start, bringing the generating set to full speed in a few seconds. The Diesel motor runs on an average only about 60 per cent of the running time of the car, which permits considerable saving in oil, lubricant and wear. The author gives several tabulations of cost comparisons between this car and gasoline-electric, benzol-electric and steam-locomotive types, and comes to the conclusion that the over-all cost per train-kilometer of the Diesel-electric train is about three-fifths that of the steam locomotive.—*L'Industrie Electrique*, April 25, 1921.

Installations, Systems and Appliances

X-Ray Apparatus for Workshop Use.—The apparatus described was designed in the form of a portable self-contained unit capable of continuous operation under rough workshop conditions and by unskilled labor.—London *Engineering*, April 29, 1921.

Study of Underground Electrical Prospecting—I.—A description of how prospecting is carried out by making a potential chart, with suggestions regarding the use of non-polarizing electrodes and the recommendation of direct current for this work.—*Engineering and Mining Journal*, May 7, 1921.

Variable-Speed Motors in Heavy Industries.—S. PARKER SMITH.—This discussion deals briefly with the application of variable-speed motors, both direct-current and alternating-current, to heavy industries from the point of view of the electrical designer.—London *Electrician*, April 29, 1921.

X-Rays and Their Industrial Applications.—Abstract of a lecture by G. W. C. Kaye. Characteristics of X-ray heat are discussed. Excellent work done in the investigation of crystalline material and the examination of products of the industrial plants is described.—London *Electrician*, April 29, 1921.

Electrodynamic Forces in Electric Furnaces.—CARL HERING.—A number of recently discovered mechanical forces are described which are of electrical origin and which may be made use of, or may be detrimental, in some types of electric furnaces, chiefly those in which the heat-developing resistor is a liquid, which responds to these forces more readily than a solid. Such forces may be usefully applied to cause the liquid metal to flow very rapidly through the heat-developing resistor, thereby enabling the furnace to be forced and to cause a strong upward circulation in an adjoining bath by which the metal is refined of suspended impurities and made homogeneous. After referring briefly to the formerly described "pinch effect," a description is given of the "stretch effect" and of the "corner effect," known also as the "motor effect."—From paper presented before American Electrochemical Society, April 21, 1921.

Electrophysics and Magnetism

X-Ray Crystal Analysis of Thirteen Common Metals.—ALBERT W. HULL.—The author's method of powder analysis was used. The metals investigated are chromium, molybdenum, tantalum, cobalt alpha and beta, nickel, rhodium, palladium, iridium, platinum, zinc, cadmium and ruthenium.—*Physical Review*, May, 1921.

Electrochemistry and Batteries

Electric Trucks and Industrial Locomotives.—In this concluding number of the series equipment and methods for charging storage batteries are discussed.—London *Engineer*, April 29, 1921.

Experiments on the Corrosion of Iron and Steel.—T. S. FULLER.—A record of observations on the behavior of drops of water standing on pure iron and other materials, also standing partly on iron and partly on zinc or brass. Results of oxidation are usually perceptible in one minute and quite marked in fifteen minutes. If the drop evaporates completely, well-marked zones remain on the metal. Progressive placing of fresh drops on the same spot and allowing them to evaporate showed that the first drop was much more active than subsequent drops, indicating that a partial immunity is progressively built up. Copper steels were compared with cold-rolled wrought iron, showing copper to slow up the rate of rusting.—From paper presented before American Electrochemical Society, April 21, 1921.

Units, Measurements and Instruments

An Electric Battery Vehicle Meter.—GEORGE J. DUCKETT.—The writer states his belief that there is one type of meter that stands up to the requirements of the electric road vehicle. This is the mercury motor meter designed to withstand the maximum rate of charge, in which the main current is carried by a shunt and only a small percentage is allowed to pass through the mercury bath.—London *Electrician*, April 29, 1921.

Electric Strength of Air Under Continuous Potentials and as Influenced by Temperature.—J. B. WHITEHEAD and F. W. LEE.—The paper describes a series of experiments on the influence of temperature on corona-forming continuous potentials. The observations were made on three sizes of wire of diameters of 0.0251 cm. and 0.0933 cm., and in each case at several values of temperature within the range of 5 deg. C. and 70 deg. C. The observations show that under constant conditions as to pressure and temperature a higher value of negative potential than positive potential is required to form corona. The experiments substantiate the empirical laws developed by Whitehead and Peek, although the constants of the equations involved are higher than any heretofore observed. There are some indications that at temperatures in the neighborhood of 70 deg. C. a departure from the empirical laws mentioned may set in.—*Journal of A. I. E. E.*, May, 1921.

Telegraphy, Telephony and Signals

Static Frequency Doubles.—J. F. PETERS.—The development of the static frequency doubler has been brought about by the difficulties in constructing alternators for very high frequency, the scheme being to generate at a lower frequency and raise this frequency by means of such a combination as two transformers with three windings each, as described by the writer.—*Electric Journal*, April, 1921.

Organization of Machine Telegraphs.—ARTHUR

JAMES POLLEY.—The writer calls attention to the need of machine telegraphy for modern high-speed work and describes some of the apparatus of modern design. *Beama* (British Electrical and Allied Manufacturers' Association), April, 1921.

Frequencies and Damping Factors of Coupled Circuits.—LOUIS COHEN.—The general theory of coupled radio-frequency circuits is developed for systems having two degrees of freedom and for the resonance and non-resonance conditions. The theory is mathematically applied to determine the frequencies and damping factors for inductively coupled, directly coupled and electrostatically coupled circuits.—*Proceedings Institute of Radio Engineers*, April, 1921.

Specifications and Characteristics of Moorhead Vacuum Valves.—O. B. MOORHEAD and E. C. LANGE.—A number of types of Moorhead tubes are described, together with the mode of testing them and the specifications to be met. The tubes obtained are classified as detectors or amplifiers, which types the authors regard as separate and generally non-inclusive. The effects of small variations in a number of the tube dimensions are exhaustively studied, and conclusions are drawn as to the effect of varying the various tube dimensions.—*Proceedings of Institute of Radio Engineers*, April, 1921.

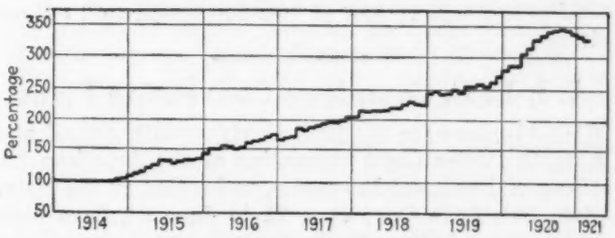
Continuous-Wave Radio Communication.—D. G. LITTLE.—The writer deals with the three principal methods of continuous-wave generation, namely, arc generators, high-frequency alternators and vacuum tubes.—*Electric Journal*, April, 1921.

Generators for Wireless Telegraphy.—KARL SCHMIDT.—Designers of medium-frequency and high-frequency generators will find in this article details, drawings and photos never before published. The bulk of the article deals with different types of generators used for the operation of quenched-spark sending stations, that is, machines producing up to 600 cycles per second. Several solid-steel-rotor, unipolar machines are described, and their characteristic curves are given. There is a large demand for medium-frequency machines of from 0.05 kw. up to 300 kw. output, which has resulted in highly developed standard types. During the war a large number of these machines, rated at about 350 watts, 600 cycles, and simultaneously at 200 watts, 500 volts direct current, operating at 4,500 r.p.m. and weighing only about 17 lb. (7.7 kg.), have been used on airplanes. A wound-rotor type for 1.5 kw. weighing only 48 lb. (22 kg.) is shown. Great prominence is given a new type of generator developed by the author during the war which found widest use in the German army and navy. It is a type with all windings stationary and a laminated, toothed rotor. The author claims for his machine the smallest weight and highest efficiency ever reached for such generators; for example, 11 lb. (5 kg.) for a 500-watt alternating-current plus 250-watt direct-current type, or 82 per cent efficiency for a 2-kw. type. A very compact, portable, gasoline-driven 1.5-kw. alternating-current plus 1.0-kw. direct-current type is described. Dealing with high-frequency machines, the author does not consider it as reliable to go beyond 3,000 r.p.m. or 450 ft. (137 m.) peripheral speed per second. The multiplying of frequency in stationary transformers according to Jolly-Arco and Goldschmidt is touched upon, assuming eightfold and threefold respectively as safe limits. Characteristic curves are given of a 7,000-cycle machine in actual operation.—*Elektrotechnische Zeitschrift*, March 17 and 24, 1921.

Importance of the Great Radio Center of Paris.—The present capacity of wire telegraph lines is not adequate to the needs of France. This applies both to inland use and to foreign communication. Radio service from the four existing large stations, however, amply fulfills all needs. The French radio service embraces four distinct divisions—service outside Europe, European service, colonial service and information service. To transmit from Paris to New York 500 kw. is used and from Paris to South America 1,000 kw. A short description is given of the high power stations in Paris (Eiffel Tower), Lyons, Nantes and Bordeaux. All four operate regularly with the Poulsen arc system. It is realized, however, that the arc system has many disadvantages as compared with a system with high-frequency generators. In two of the above-named stations, therefore, generators have been installed at first for experimental use. The state has erected high-frequency generators of 50 kw. to 500 kw. output, using an entirely French type, with simple, non-rotating winding, no condenser circuit and not requiring a specialist for repairs, and is equipped to build these machines, whose efficiency, it is claimed, is the highest ever attained in similar generators. Twenty of these machines have been delivered so far and fifty are under construction. Two methods of recording the received messages have been perfected—the phonographic system, capable of 100 words per minute, and the photographic system, reaching up to 500 words per minute. —*Radio Electricité*, Vol. I, page 378.

Miscellaneous

Engineering Costs.—FRANK WALKER.—An analysis of engineering costs from the period of 1914 to date. Under engineering costs are listed labor costs, material



INCREASE IN COST OF AVERAGE ENGINEERING PRODUCT, INCLUDING MATERIAL AND LABOR

costs, overhead charges and average product costs.—*Beama* (British Allied Electrical Manufacturers' Association), April, 1921.

Scholarship and Eminence in Engineering.—RAYMOND WALTERS—Of 580 eminent engineers who were college graduates the collegiate records of 392 were examined. Of these 182, or 46.4 per cent, stood in the highest fifth of their classes scholastically; 109, or 27.8 per cent, stood in the second highest fifth of their classes scholastically; 72, or 18.3 per cent, stood in the middle fifth of their classes scholastically; 14, or 3.6 per cent, stood in the next to lowest fifth of their classes scholastically; 15, or 3.8 per cent, stood in the lowest fifth of their classes scholastically. This analysis is offered to show that scholarship is of equal importance with character, judgment and other requirements as brought out by the Mann report.—*Bulletin of Society for Promotion of Engineering Education*, April, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Niagara Falls Development to Use Water Under Higher Head

WITHOUT obtaining any additional water the Niagara Falls (N. Y.) Power Company is going ahead on its fifteen million dollar project by using some of the water under an increased head. The "Niagara" plant, which secures only a little more than half the power per second-foot of water as the new plant completed last year, is to be abandoned. The new plant will be extended further in about the same way as previously and the additional power developed there.

The full 314-ft. head is not being used in the present development. This would involve the abandonment of present efficient plants. Instead the head will be used in two stages, the first by 220 ft. and the second 94 ft.

A 32-ft. U-shaped tunnel, on which work is now progressing, will bring the water at a depth of approximately 100 ft. below ground from Port Day to the penstocks through a forebay similar to that provided for the plant finished last year. This, it has been reported, will raise the system capacity 187,500 hp. It is expected that the first unit of this new development will be ready for operation before May 1, 1923.

Part of this power, it has been learned, will be delivered over a new 66,000-volt line now under construction to the Buffalo General Electric Company. This new line, which will have a capacity of approximately 100,000 hp., will consist of two 500,000-circ.mil copper circuits.

A. I. E. E. Completes Convention Plans

FINAL plans for the joint thirty-seventh annual and tenth Pacific Coast convention of the American Institute of Electrical Engineers, to be held at the Hotel Utah, Salt Lake City, June 21 to June 24, have been made. An addition to the tentative program of the technical sessions, as published on page 1009 of the ELECTRICAL WORLD for April 30, comes in the form of an address entitled "Little Things from Little Places," by Guido Semenza, local honorary secretary of the A. I. E. E. for Italy, who is a consulting engineer at Milan. This address will be made at the Friday morning session.

Gov. Charles R. Mabey will welcome the convention on Tuesday, June 21. In the afternoon of that day there will be a trip on foot to the historical buildings of the Latter Day Saints, followed by a lecture and organ recital in the Tabernacle, with an evening trip by automobile to the Wasatch Boulevard and Capitol Hill. On Wednesday afternoon an excursion by train affording views of Great Salt Lake and an opportunity to inspect a typical mining canyon will be held, and a musical entertainment will follow in the evening.

On Thursday there will be special entertainment for the ladies, an afternoon trip to the Utah Power & Light Company's great outdoor substation, the terminus of three 130,000-volt transmission lines, and an evening illustrated lecture on the Utah canyons. On Friday golf and tennis finals and a baseball game between East and West will be played. A visit to Saltair Beach for bathing and a "big Western dinner" in the Ship Café, followed by dancing, are also scheduled for this day.

Arrangements for many "after convention" trips to points of engineering interest and also to various resorts, canyons and mountain parks, including Yellowstone and the Grand Canyon, have been completed. These trips will take from one to ten days each.

Damage to Electric Properties in Flooded District of Colorado Slight

REPORTS received by the ELECTRICAL WORLD for electric light and power properties operating in the Colorado flood area clearly indicate that the early newspaper reports were greatly exaggerated. The greatest damage was suffered by the Byllesby property at Pueblo, the Arkansas Valley Railway, Light & Power Company, and this it is estimated will not exceed $100,000. Damage to the Colorado Power Company was of a minor nature. The only source of anxiety to the management of this property was the possibility of curtailment of the coal supply at Sterling. The Electric Bond & Share Company's properties were to the west of the flood and consequently were not affected at all. Henry L. Doherty & Company properties serving Denver and Boulder and near-by towns report no serious effects from the swollen rivers. The service of the United Gas & Electric property at Colorado City was interrupted occasionally by lightning and was out of service in all for about half an hour.

Reports from the Pueblo property state that there were no breaks in dams or reservoirs. No damage was done to the Cañon City plant or to the transmission lines. Except a little caused by mud no damage was sustained by the Pueblo power plant. The company lost no street cars and its traction system is said to be in excellent condition. No loss from fire was sustained by the company and its office building and all records are intact. The lighting system is in operation, and the company said on Wednesday that it should be back completely on the old basis in ten days. The Pueblo power plant is closed down and will remain so until about the end of next week. In the meantime emergency service is being obtained from near-by industrial plants. The only damage done to the Skaguay hydro-electric plant was the tearing away of about 150 ft. of wood-stave pipe which at the time this was written was being replaced.

Most of the $100,000 needed for replacing service will be spent in removing mud and débris and in cleaning up.

A detailed report from the Colorado Springs company was to the effect that while some of the embankments for the conduits of the hydro-electric plants were

washed away no damage of a serious nature was done. There were some minor interruptions, amounting to half an hour in all and resulting from heavy short-circuits caused by lightning. The greatest inconvenience was caused by telephone lines going down owing to rock slides, making it impossible to get any information back and forth for load dispatching.

There were some temporary interruptions on the Doherty lines. The line to Denver from the Colorado Power Company was down in a few places for a few hours. The main transmission line of the Western Light & Power Company, Northern Colorado Division, was down about twenty-four hours. Repairs were effected at all places and service has been going on ever since.

Light and Power Financing of the Week

THREE light and power company issues were announced the past week—$3,000,000 of three-year 8 per cent sinking fund mortgage bonds of the Columbus (Ohio) Railway, Power & Light Company at 98, yielding more than 8.75 per cent; $750,000 of twenty-year 8 per cent bond-secured gold notes, series B, of the Southwestern Power & Light Company on an 8.10 per cent basis and $1,200,000 of first-lien and refunding 7 per cent bonds of the Northern New York Utilities, Inc., due 1946, at par. The latter issue is not subject to redemption prior to maturity.

In addition, the Department of Public Utilities of Massachusetts has approved the issue of $1,200,000 of 5 per cent first-mortgage bonds of the New England Power Company at 77½ and 12,000 shares of stock at not less than $120 a share. The Illinois Public Utilities Commission has authorized the Central Illinois Public Service Commission to issue $151,000 of first refunding 5 per cent bonds maturing Aug. 1, 1952, and $50,000 of general-mortgage 6 per cent bonds of the same maturity. The Massachusetts Department of Public Utilities has approved the petition of the Plymouth Electric Light Company to issue $100,000 par value additional capital stock to take up outstanding promissory notes.

Chicago Licensing Ordinance Widely Opposed

A COUNCIL committee hearing on the proposed Chicago ordinance to license and regulate the sale in that city of electrical goods, held June 2, brought out the fact that opposition to the ordinance is becoming national in character. The discussion, lasting three hours, early showed that sentiment among electrical manufacturers is almost solidly against the ordinance, and representatives of the music and real estate industries voiced their opposition also.

Letters gathered by Paul Westburg, representing the electrical division of the Chicago Association of Commerce, showed that the matter had become more than purely a local one. Manufacturers situated in all parts of the country backed up the Association of Commerce in its fight against the bill.

Mr. Westburg, who is Chicago representative of several meter manufacturers, declared that the ordinance would not accomplish its avowed object of protecting the public by testing all devices and licensing their sale. He said that unscrupulous firms would locate outside of the city and do a mail-order business while Chicago manufacturers and dealers were handicapped by the added overhead expense of license and test fees.

A. W. Berresford, president of the American Institute of Electrical Engineers, asserted that if there is need for such regulation it should be national and not local.

Ainslee A. Gray, representing the Electric Club of Chicago, mentioned as objections against the ordinance the great expense of maintaining sufficiently large municipal testing laboratories and the amount of power placed in the hands of one man, the city commissioner of gas and electricity.

Other speakers opposing the ordinance were J. W. Perry, representing the Associated Manufacturers of Electrical Supplies; C. H. Roth, secretary of the Power Club; W. L. Goodwin of the Society for Electrical Development, and several speakers representing local real-estate men. In all cases the demand was that the ordinance be killed entirely.

Much of the objection centered on the huge expense to both the industry and the taxpayers that the ordinance would entail. It was pointed out that a highly paid corps of experts and millions of dollars in instruments and buildings would be necessary to carry out the necessary testing.

The committee adjourned the hearing until the afternoon of June 16, when still others will be heard in opposition.

Electrical Supply Manufacturers' Summer Section Meetings

THE following schedule has been proposed for the summer section meetings of the Associated Manufacturers of Electrical Supplies to be held at the Griswold, Eastern Point, New London, Conn., from June 27 to June 30:

Monday, June 27.—Sub-committees of general standards committee, general standards committee, Wire and Cable Section, weatherproof-wire group, magnet-wire group.

Tuesday, June 28.—Heating Appliance Section, Signaling Apparatus Section, Armored Conductor Section, Non-Metallic Flexible Conduit Section, Metal Molding Section, Rigid Conduit Section, Snap Switch Section, Lamp Receptacle and Socket Section, Attachment Plug Section; banquet and entertainment in the evening.

Wednesday, June 29.—Panelboard and Switchboard Section, Air Circuit Breaker Section, Radio Apparatus Section, Industrial Lighting Section, Carbon Section; meeting of the board of governors.

Thursday, June 30.—Fuse Section, Knife Switch Section, Molded or Formed Insulation Section, Line Material Section.

California Safety Orders Progressing Rapidly

THE sub-committee engaged in the final revision of the electrical utilization safety orders of the Industrial Accident Commission of California have about completed their various sections for return to the general committee. It is expected to have a general committee meeting within sixty days, and after passage by this committee the revised orders will be sent to the printer for publication in tentative form. After this the commission will hold a public hearing for final discussion on the orders, and it is expected that the administration of them will begin Jan. 1, 1922.

These are general orders of the Industrial Accident Commission. They relate to the installation and use of electrical utilization equipment in industrial establishments and are designed to promote the safety of employees by the prevention of electrical hazards.

Patent Office Bill to Be Reported Out

THE bill introduced by Representative Lampert providing for increased salaries in the Patent Office is to be reported out in the near future. It is known that there is no opposition to the measure in the committee. Prompt action by the House is anticipated. This bill failed at the last session because of insistence by Senator Norris, then the chairman of the Senate committee on patents, that the Senate decline to recede from its amendment authorizing the Federal Trade Commission to administer patents for government employees.

Light and Power Users of Southern Idaho Form Organization

SOUTHERN Idaho electric light and power users perfected a permanent organization, known as the Southern Idaho Electric Light & Power Users' Association, at a meeting of more than thirty-five representatives of municipalities and irrigation projects held at Boise last month. An executive committee was named, with full power to act for the association before the State Public Utilities Commission in regard to the Idaho Power Company's valuation hearing and all other power hearings. Funds for the work of the association will be raised by contributions of members of 1 per cent of either their 1920 or their 1921 power bills. Members will not be called on for payment until at least $10,000 has been subscribed.

Technical Committee of Communication Conference to Meet in Paris

THE provisional technical committee appointed by the International Communication Conference, which met recently at Washington, will meet in Paris on June 20 to consider and report upon technical matters in advance of a general international conference. Among the matters with which the conference is dealing are the disposition of the German cables and some means of controlling international radio communication. The Paris meeting is to be attended by delegates from the same countries as participated in the Washington conference, namely, France, Great Britain, Italy, Japan and the United States.

The United States delegation will be headed by Gen. George O. Squier, the chief signal officer of the army. The Navy Department will also be represented by four officers who have specialized in radio, among them Admiral Bullard and Dr. L. W. Austin. The Department of Commerce will be represented by Dr. A. E. Kennelly and Dr. J. H. Dellinger.

Connecticut Industrial Plants May Market Energy

GOVERNOR LAKE of Connecticut has signed a bill providing for the sale of electricity for lighting, heating and power service incidental to manufacturing purposes by corporations authorized to construct and operate hydro-electric plants, subject to the approval of the Public Utilities Commission. The bill provides that no such company, however, shall distribute or sell electricity in any town in which any other company has already received the right to distribute and sell electricity. The commission is to have jurisdiction over the expediency, terms and rates of such electrical supply by a private corporation. When this bill was introduced it was feared that the broad powers conferred by it upon industrial and other corporations owning and operating hydro-electric dams and plants would threaten the tenure of the market of existing public utilities, but in the measure as passed the Legislature recognized the unwisdom of this sort of competition.

Electrical Industry Fundamentally Sound, Says Shiras Morris

"NOTHING in the present sub-normal business situation justifies the conclusion that the electrical industry as a whole is in anything but a fundamentally sound condition," said Shiras Morris, president of the Associated Manufacturers of Electrical Supplies, to a representative of the ELECTRICAL WORLD a few days ago. Without overlooking the large opportunity for improvement in both domestic and foreign trade, Mr. Morris stated that all over the United States hopeful signs can be seen pointing to a business revival. The speed with which normal conditions can be restored is the chief element of uncertainty, but a comparatively rapid recovery is anticipated, perhaps within a few months.

SHIRAS MORRIS

The liquidation of raw-material costs has been virtually completed, in Mr. Morris' opinion. Ample supplies of raw material are available now on prompt delivery for substantially every branch of electrical manufacturing. The liquidation of labor, while proceeding gradually, is not as yet finished. A better productive effort is evident through the entire range of employed labor today, and the electrical industry is fortunate in that the residual permanent demand for its products has enabled manufacturers to retain in their employment a much larger percentage of efficient labor than has been retained in many other lines.

Another point emphasizing the stability of the electrical industry is its catering to the necessities of the population. Beyond temporary shut-downs for inventories or short readjustments, manufacturing has continued at least on a moderate scale in almost every branch of electrical commodity production. In other words, electrical manufacturing plants have not "gone dead," as was the fate for the time being of many industrial establishments during the depression's worst phases. A gradual restoration of better business resulting from the liquidation of labor at a rate sufficiently slow to prevent sharp shocks to the economic structure of industry seems preferable to more sudden and violent readjustments.

For the first time American manufacturers are giving scientific study to tariff matters, and some degree of protection must be had against the dumping of inferior products or of commodities produced by low-

grade labor onto American markets, both North and South. The meeting by Germany of her reparations responsibilities will help international economic conditions somewhat, but probably not so much as some observers believe. The ultimate restoration of sound economic conditions in Russia will be another potent factor in world trade improvement.

Buying in moderate quantities is still justified in the American electrical industry. Mr. Morris recognized that prices advanced far less in the electrical industry during the war than in many others, and said that while further declines are possible, the present volume of business in many lines might be doubled without economically justifying reductions from the present level. Overhead expenses are so high under the existing volume of trade that unreasonable expectations should not be entertained as to price movements in the near future. Now is a good time for manufacturing plants to undertake rehabilitation work tending toward increasing production efficiency when "mass" orders are later handled.

Pacific Coast Men Discuss 220,000-Volt Transmission Problems

TRANSMISSION at 220,000 volts received more attention than anything else at the annual convention of the Pacific Coast Geographic Division of the National Electric Light Association, held this week at Del Monte, Cal. The total registration up to Wednesday night was approximately 250. In the opening session President L. H. Nerbert stated that improvements should be made in the organization of the division in order to extend the scope of its activities, make them of greater direct application to the membership and better knit the division with the national association. He suggested that several bureaus be organized, patterned along lines similar to those of the national organization.

The main problems remaining yet to be solved in the use of 220,000-volt transmission lines are principally those of insulation and refinement in the laws relating to corona, according to J. A. Koontz, electrical engineer of the Great Western Power Company and chairman of the 220,000-volt transmission committee. He asserted that there are still some doubts as to the effect of the surface of large-size conductors on corona. The effect of rope stranding or the use of special strand combinations to increase the effective diameter needed additional experimental work. He suggested that corona-loss measurements be made on a new high-voltage line and the test repeated after several years' service.

There are at present several methods of solving the insulation problem. One method is that of a larger unit than the common 10-in. disk, or a unit that will be capable of carrying a higher voltage duty. Another method would be to grade the units in an insulator string to give equal voltage distribution. From ten to fifteen such disks should be used on a 220,000-volt line, Mr. Koontz said.

In the discussion the general opinion was expressed that the problem of increasing transmission voltages to 220,000 or higher was now well understood and that the application of such voltages was a question of economics. As the use of more than eight units in a string will not reduce the voltage duty of the line-end unit, it will be necessary to use one of the several forms of shields which have been evolved to reduce the charging current now passing through these units. Of the forms of shields experimented with it appears more desirable to use one carrying a porcelain insulator. Mr. Koontz pointed out that lines operating at normal voltages cannot possibly have generated in them at normal frequencies voltages sufficiently large to flash over strings of thirteen or fourteen units, and consequently it is beyond question that the flashovers must be caused by high-frequency transients, because voltages of this character only are able to flash over air gaps of the length of such insulator strings. He expressed the opinion that the most feasible method of suppressing such transients is to design a line for operation at very nearly corona voltage so that any increase in voltage would be dissipated as corona. Experiments to so determine the form of the electrostatic field surrounding insulator strings as to relate the size, shape and location of the shields in such a way that the stress on the line-end units will be decreased and at the same time not unreasonably decrease the flashover distance to the tower and crossarm were described by Prof. H. J. Ryan. He pointed out that the suppression of flashovers on long strings of insulators is primarily concerned with control of the primary field. If this is correctly designed, the secondary field formed at the end of an incipient flashover streamer will not become predominant, with the result that a flashover would be directed away from the string by the primary field and thus prevent injury to the porcelain. He stated that altogether more than 400 different set-ups of insulators and shields had been made in order to study these points. The use of insulators other than standard in order to produce graded strings has not been thought desirable at this time by the Pacific Gas & Electric Company, which is at present installing a 220,000-volt line from the Pit River development.

Power Resources of California

A summary of the hydro-electric installations in operation and in progress of construction and the ultimate possible installation was presented to the convention by the committee on power resources of California under the chairmanship of P. M. Downing of the Pacific Gas & Electric Company. This report showed that on Dec. 31, 1920, there was in California 946,305 hydro-electric horsepower in service, 345,510 hp. in process of construction and an ultimate possible output of 4,646,357 hp. A summary of storage in reservoirs at present in operation showed 730,467 usable acre-feet, which could produce 773,631,610 kw.-hr. per annum. In progress of construction are reservoirs having a capacity of 243,500 acre-feet, capable of generating 422,040,000 kw.-hr. per annum. The ultimate storage, according to this report, was 2,857,778 acre-feet, which could produce 5,892,008,730 kw.-hr. per annum. The report listed in detail all of the present hydro-electric installations in the state, giving their location; the names of the power houses; the capacity of the installation in horsepower at present, in progress, and ultimately possible; and the ultimate output in kilowatt-hours from storage, from steam flow and the total.

The totals of the amount of hydro-electric power available in this report do not check with the totals given by other authorities, and it was believed that the committee making this investigation should continue its work.

Gradual Business Improvement Predicted by A. W. Douglas

NO IMMEDIATE return to prosperity is in sight, according to the semi-annual report of Archer Wall Douglas, chairman of the committee on statistics of the Chamber of Commerce of the United States, which deals with business and crop conditions. There need be no delusions about a resumption of a war-time volume of business, Mr. Douglas declares, but while things will be quiet during the summer, the termination of harvest may bring somewhat better business and a slow and gradual improvement.

"There is a growing realization of the fact," Mr. Douglas says, "that returning prosperity in this country depends upon the recovery of Europe, since she is and will be for a long time to come the best market for that surplus which we have accumulated and still have on hand in every kind of industry. Meanwhile the slow progress of business finds its chief stimulus in the gradual depletion of stocks both of merchandise and commodities and that demand for replacement and repair which in itself produces the principal volume of our domestic commerce. There is still money to be spent where bargain prices are in evidence."

Mr. Douglas finds agricultural prospects fairly satisfactory, declares that one of the serious conditions is the slow growth of building due to the continued high costs of construction, and says that there has been some increase in the output of automobiles, that leather production and manufacture have struck bottom and had a moderate rebound, and that the steel industry is running on short time with limited output and reduction of orders in hand. Railroad shops are very quiet. Textiles, particularly wool and linen, and shoes are doing somewhat better. Mining in general is very dull and where running is doing so on short time. The railroads, he says, are using their utmost endeavor to economize, and there is hope for a reduction in the cost of transportation. "One of the interesting developments of the time," he adds, "is the growth of the electric trolley car and the auto truck in short hauls, in which they are already formidable competitors of the steam railroad."

Most of the Responsibility for Waste Laid at Door of Management

MANY causes of waste and recommendations for their elimination are given in the report of the American Engineering Council's committee on elimination of waste made at a meeting of the council's executive board on Friday of last week in St. Louis. Responsibility for more than 50 per cent of these wastes are placed at the door of management and less than 25 per cent at the door of labor.

The investigation, which was in charge of a committee of sixteen, was carried on by a large force of field workers in New York, New England and Pennsylvania and deals with housing and building, ready-made men's clothing, shoes, metal trades and printing.

The report comprises 125,000 words and will be made public when some necessary changes have been embodied.

A number of other committees made reports, many of which were laid on the table. In the afternoon the report of the foreign relations committee was received and a list of appointments made consisting of Dugald C. Jackson, Boston, Mass.; J. Parke Channing, New York City; C. O. Mailloux, New York City; T. A. Richard, San Francisco; M. O. Leighton, Washington, D. C.; Nelson P. Lewis, New York City; John W. Lieb, New York City; Louis S. Cotes, Salt Lake City, and Bion J. Arnold, Chicago.

Election of a president to succeed Mr. Hoover will take place this fall.

N. E. L. A. Pledges Continued Aid to Federal Power Commission

THE following resolution was adopted by the National Electric Light Association at the Chicago convention last week, at the suggestion of the committee on water power:

Whereas the water-power development committee, after repeated conferences with the Federal Power Commission and its executive staff, has reported that in the opinion of the committee of this association the Federal Power Commission has adopted rules and regulations of a constructive nature, which, while necessarily definite and strict, will not prevent development of water-power resources under federal licenses, but will encourage much development, now, therefore, be it

Resolved, that this association express to the Federal Power Commission its appreciation of the spirit in which the Federal Power Commission has accepted the co-operation of this association and that this association pledge its representatives to continued co-operation with the Federal Power Commission to the end that the water-power resources of the nation may be developed without conflict between federal and state authorities and to the mutual advantage of the federal government and the people served.

Federal Power Commission Rulings

WHEN reservoirs are constructed in connection with any project coming under the jurisdiction of the Federal Power Commission, the applicant will be required to remove standing timber unless he can show sufficient reason why it should not be done, according to a ruling made by the commission on June 6 in connection with the reservoir of the Alabama Power Company at Duncan's Riffle. In that case the power company will be required to remove the standing timber at a cost of $20,000 or more.

The commission passed on several declarations of intention. It was decided that the interest of interstate or foreign commerce will not be affected by the project of Oran W. Montgomery for a power project on Rocky Creek near Lakewood, N. Y.

The interests of interstate commerce, it was found, would be affected by the development proposed by John W. Shafer on the Tippecanoe River, Indiana, unless the project could be carried forward without diverting water from the Kankakee River.

The Grand River Hydro-Electric Company's proposed development on the Grand River, Oklahoma, was also found to interfere, because it would reduce the normal discharge of the Grand River into the Arkansas, thereby affecting navigation on the latter stream.

The proposed developments by the Kentucky-Elkhorn Coal Corporation on the Big Sandy River, Virginia, and the Sequoyah Hydro-Electric Power Company on the Illinois River, Oklahoma, were found not to conflict with the interests of interstate commerce.

The commission consented to a joint meeting with the International Joint Committee at some future date, when the procedure to be followed in handling projects on boundary streams and projects involving the level of international waters will be discussed.

Award of Doherty and Billings Prizes

AMONG the features of the last day's session of the Chicago N. E. L. A. convention was the announcement of the winners of the Doherty and Billings prizes. They were respectively T. G. Price of the Commonwealth Edison Company, whose paper was entitled "The Friendship of Our Customers," and Clifford W. Bates, Philadelphia Electric Company, who wrote on "Power Factor, Its Cause, Effect, Measurement and Remedies."

Rocky Mountain Electrical Co-operative League Gets Together

MORE than two hundred members of the various branches of the industry attended the first "get-together" meeting of the Rocky Mountain Electrical Co-operative League, held at the Commercial Club at Salt Lake City on the evening of May 23. J. A. Kahn, president of the Capital Electric Company and chairman of the advisory committee of the league, was master of ceremonies.

The first speaker was George R. Randall, manager of the Salt Lake Electric Supply Company, who outlined the objects of the league, explaining why it was organized, what it had accomplished so far and what it hoped and expects to accomplish in the future. H. T. Plumb, local engineer of the General Electric Company, who is also chairman of the convention committee of the local chapter of the A. I. E. E., announced briefly the plans for the entertainment of the convention delegates in Salt Lake City in June and urged that every one in the electrical industry make it his particular duty to see that the convention guests are taken care of in a proper manner.

Wilson McCarthy, a Salt Lake City attorney, spoke on the subject of co-operation. Another feature of the evening was an illustrated lecture on Utah's scenic wonders by Dr. J. E. Broaddus. Mr. Kahn announced that the construction of the electrical home is now under way. It will be completed early in September. The league will have charge of the home for two weeks for exhibition purposes, during which time it will be open to the public for inspection. At the conclusion of the program a buffet luncheon was served.

No Pessimism Marks Electrical Supply Jobbers' Meeting

THE annual meeting of the Electrical Supply Jobbers' Association was held at Hot Springs, Va., on May 25-27. Although the electrical supply jobbing business shows a falling off, the showing over pre-war times is sufficiently large to give encouragement, and the jobbers in attendance at Hot Springs were anything but pessimistic. J. L. Owen of New York was elected a committeeman in the Atlantic division to succeed H. T. Hochhausen, and Clarence Wheeler was re-elected. The chairmanship of the Atlantic division, formerly held by F. E. Stow of Philadelphia, went to George L. Patterson of New York, and E. W. Rockafellow of New York, F. W. Bernardin of Kansas City and W. R. Hirstein of Memphis were elected committeemen at large.

M. H. Aylesworth, executive manager of the N. E. L. A., made such an impression with a talk on co-operative methods in upbuilding the industry that he was invited to address the executive session and explain more in detail how the electrical supply jobbers can co-operate with the N. E. L. A. in furthering electrical development. At his suggestion the supply jobbers sent representatives to the convention of the N. E. L. A. in Chicago.

Herman Plaut of Boston urged a greater interest by jobbers in proper electrical illumination and asked that they support the Illuminating Engineering Society through membership in that organization. The attention of the meeting was called by W. W. Low of Chicago to the menacing terms of an ordinance seeking to tax all electrical products used in Chicago, and plans were made to have delegates appear at the public hearing and present the views of the jobbers in opposition to the ordinance.

W. L. Goodwin described in a forceful manner the plans which the Society for Electrical Development has in contemplation for expanding its work. These plans were outlined in the ELECTRICAL WORLD on May 21. Great interest was evinced by the jobbers in the society's new work and in Mr. Goodwin's leadership.

Samuel A. Chase of the Westinghouse Electric & Manufacturing Company delivered an address on "The Straight Path," and A. MacLachlan of the Square D Company spoke on the jobbers' responsibility in the safety movement.

A strikingly illustrated lecture on the Hydro-Electric Developments of the Niagara Falls Power Company was given by George S. Anderson of that company. Various meetings of special committees were held during the week, and the convention, which was largely attended, was marked by the usual entertainment features.

Government's Attitude on Trade Association Stated

RECENT announcements by the Secretary of Commerce and by the Attorney-General make clear the attitude of the federal administration toward the trade organizations of the various industries. The Attorney-General has given notice that he will push a test case against one of the open-price associations, but there will be no dragnet thrown over all the associations and there will be no wholesale indictments.

Secretary Hoover authorized the following statement:

All are agreed that the purposes and actions of the vast majority of national associations are a constructive contribution to public welfare. Their activity in promotion of better business practices, advancement of technical processes, simplification of production, standardization of quality, extension of foreign trade, commercial arbitration, etc., all make for more efficient industry and business. Many of them collect information as to the production, stocks of raw and other material, percentage of industry in active operation, total orders in hand—all of which, when available to the public, contribute both to stability and the increasing efficiency of industry and to the protection both of the smaller manufacturer and the consumer. The Department of Commerce wishes to co-operate and assist in all of this sort of effort.

A smaller number of such associations have been engaged in the collection of data on the prices for the exclusive use of their members. Some of these associations have been charged with delimiting areas of commodity distribution among their members and other misuses of information.

Whether these latter practices constitute a violation of the national anti-trust laws must be determined by the courts, and this the Attorney-General is vigorously proceeding to find out.

Western New England Inspection Conference a Success

A JOINT electrical conference attended by about 150 manufacturers, consulting engineers, municipal inspectors, contractor-dealers, jobbers and insurance men was held at the Travelers' Auditorium, Hartford, Conn., May 18, for the discussion of fire and accident hazards. The program included topical discussions of grounding rules, terminology, safety problems and various code regulations. Dana Pierce, vice-president Underwriters' Laboratories and chairman of the electrical committee of the National Fire Protection Association, gave an illustrated talk upon "Fire and Safety Testing at the Underwriters' Laboratories," and Dr. Allan D. Risteen, director of technical research for the Travelers' Insurance Company, Hartford, spoke upon "Personal Accident Hazards." Sessions were conducted by John L. Thompson, superintendent engineering and inspection division Travelers' Insurance Company; A. A. Packard, superintendent Connecticut Power Company, Middletown, Conn.; E. S. Francis of Hartford, E. E. Sage and R. H. Mather. W. C. Wagner, assistant to the chief engineer of the Philadelphia Electric Company; Dr. M. G. Lloyd, assistant physicist United States Bureau of Standards, and Thomas Henry Day, New England Insurance Exchange, Hartford, also spoke. A resolution of sympathy with Dr. Lloyd was passed upon news of the death of Dr. E. B. Rosa, chief physicist of the Bureau of Standards. The Hartford Electric Light Company opened its steam plants to visitors during the meeting.

St. Louis Banker Pleads for More Liberal Treatment of Utilities

THAT more liberal treatment must be accorded to public utilities if they are to give the service the public demands was emphasized by W. F. Gephart, dean of the School of Commerce and Finance of Washington University and vice-president of the First National Bank in St. Louis, in an informal address before the St. Louis section of the A. I. E. E. on May 25. Even the better-informed people, he said, show a lack of appreciation of the utility problems, and he urged that the utilities give full publicity to their operations and problems.

Three factors, according to Mr. Gephart, are deserving of particular attention in a study of the public utility situation. The first is that service rather than low rates should be stressed by the utilities. Commissioners, unfortunately, have had to devote so much attention to valuations that the public views the situation as one of rates. He maintained that the American public is, after all, primarily interested in securing service and is willing to pay for good service whatever it may properly cost.

Mr. Gephart urged that utilities should be permitted to establish rates which will permit the making of plant extensions from earnings. With the competition for money which will exist for the next ten years, both domestically and internationally, utilities will find it difficult to give the public the service it wants and to make necessary extensions unless some such method can be adopted. The speaker deplored the necessity for making capital investments for additions and extensions and indicated that the result as far as the public is concerned will be substantially the same in the end.

The third factor was the necessity for broader-minded decisions on the part of the commissions. He indicated that radical changes in regulatory bodies and their functions must of necessity occur in the next few years if public utility properties are to function best.

Changes in Chicago's Electrical Code

A NUMBER of changes from the 1920 edition of the electrical code prepared by the Department of Gas and Electricity of the City of Chicago have been worked out by the committee in charge of the revision of the code and will appear in the 1921 edition, which has gone to press. One of the most important provides that alternating-current induction motors of more than 2 hp. must be equipped with starting and running fuses. In addition there must be a switch which will shunt the running fuses during the starting period, and this switch must be so designed that it cannot be left in the starting position. This requirement will not apply where thermal cut-outs or time-limit circuit breakers are used. The rule becomes effective on the issuance of the code.

Another new rule provides that after Jan. 1, 1922, one conductor of all branch circuits and one conductor of all two-wire mains from 125-250 volt systems, with the neutral grounded, must have a continuous identifying marker readily distinguishing it from the other conductor. This marked wire must in all cases be connected to the grounded wire of the system.

The new code rules that after Jan. 1, 1922, Edison plug cut-outs, except those used in connection with safety switches, must be of the dead-front or safety type. It recommends that covers for cut-out blocks where used in apartment buildings be provided with a means for designating the location of the circuits.

It has been announced by the Department of Gas and Electricity that the use of the knife switch will no longer be permitted. When the rule requiring the use of the safety inclosed switch went into effect July 1, 1920, contractors who had on hand a supply of the knife switches were requested to list them with the department and the installation of these listed switches has been permitted up to the present time. Hereafter all switches installed must be of the safety type where the rules require their use.

Western States Gas & Electric Plans Extensive Additions

THE Western States Gas & Electric Company, operating principally around Stockton, Cal., is planning the construction of additional hydro-electric plants to supplement those now in operation. The plans involve additions to its present plant on the South Fork of the American River and a new station, to be known as El Dorado, together totaling 156,000 hp. Applications have been filed with the Federal Power Commission, the California Water Commission and the Railroad Commission of California to receive the necessary authorizations to proceed with the work. It is estimated that the four units planned for the El Dorado development will be completed by the end of 1928 and that the enlargement of the present station will be finished in 1930. Since 1911 the collective load of the company has increased from 12,600 kw. to 43,100 kw. During 1920 the Western States Gas & Electric Company purchased 45,000,000 kw.-hr. of energy.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Efficiency of Electric Pumping.—Two new electric pumps installed recently at the Montreal waterworks which are guaranteed to pump 30,000,000 gal. a day each have exceeded this performance by 6,000,000 gal. each. The total supply of 72,000,000 gal. daily thus obtained has proved sufficient for the city's present needs and it has been possible to stop operation of a third electric pump and seven steam pumps.

Using Submarine Cable for Long-Distance Telephony.—An experiment in long-distance telephony by submarine cable is, it is announced, to be made by the French authorities. The Secretary of Posts and Telegraphs has left France for Morocco to arrange for the installation of the new system between the French coast and Casablanca. Experts are said to declare that telephone communication is possible by submarine cable up to a distance of 3,800 miles, which would bring France's Eastern colonies within the radius of Paris.

Westinghouse Sends Intercompany Messages by Wireless.—An interplant wireless communication service was formally opened on May 31 by the Westinghouse Electric & Manufacturing Company through the establishing of communication between the East Pittsburgh plant and the Cleveland foundry. Besides the Cleveland and East Pittsburgh factories the Springfield (Mass.) works and the Newark (N. J.) works are being equipped with stations for the transacting of company business. The system was formally opened by a message from E. M. Herr, president of the Westinghouse company, to the president of the Electrical League of Cleveland.

Water Power Versus Salmon.—Strong opposition to the Lochaber water-power bill, which embodies a large scheme for using available water power in the Scottish Highlands in generating electrical energy for the manufacture of aluminum and other industrial purposes, has been exerted by the salmon-fishing interests, which feared interference with the angling sport protected in Great Britain from time immemorial. This opposition is said to have been finally quieted by the provision that the natural flow of the Upper Spey above the intake at Loch Laggan is not to be diverted unless the flow exceeds 30,000,000 gal. in twenty-four hours. The Spey fishery board is, in addition, to have the right to demand on twelve days in the year that water shall not be taken unless the flow exceeds 100,000,000 gal.

Organization of Technical War Service.—A meeting to organize a Greater New York section of the Army Ordnance Association will be held at the Engineering Societies Building on June 15 at 8 p.m., General Guy E. Tripp presiding. All ordnance officers of the Officers' Reserve Corps and others interested are invited to attend. The object aimed at is to unite technical experts in support of the reserve armies of the United States to be organized by General Pershing.

Electrical Irrigation Agreement in Utah.—An emergency agreement has been reached between the Utah Power & Light Company and the Murdock irrigation companies whereby power will be furnished at once to begin pumping water for irrigation purposes. The agreement was the outcome of a conference held with members of the Public Utilities Commission. The irrigation companies objected to a clause in the rate as filed with the commission which required an advance payment of one-half the amount of the seasonal guarantee. The power company contended that because of the inability of certain irrigation customers to pay in the past, after they had discontinued taking service, it had sustained considerable losses. The irrigation people will furnish a bond guaranteeing the payment of the power bills.

California Power Tunnel Finished in Record Time.—The Shaver Lake tunnel of the Southern California Edison Company, which will save for southern and central California the run-off from the 32 square miles of the Shaver Lake watershed in the High Sierras and thereby increase the summer power supply, has just been completed in record time after fourteen months' continuous work, night and day, by William Kempt, tunnel superintendent, three foremen and 350 men. The tunnel, which diverts the water from Shaver Lake, is 15,720 ft. long and 8 ft. x 11 ft. in size. It was driven through a hard granite formation under Music Mountain for approximately three miles, terminating 2,400 ft. above the power house. The necessity for completing the job in time to save the snow waters of the watersheds resulted in it being pushed to completion on a bonus basis.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Empire State Gas and Electrical Association.—The Commercial Section of this association will meet at Cooperstown, N. Y., on Friday, June 24.

North Central Division, N. E. L. A.—The date of the coming convention of this division at Duluth, Minn., is June 21-23, not June 14-16, as stated in this column last week.

Oregon Association of Electrical Contractors and Dealers.—This association will hold its tenth annual convention at Eugene, Ore., next Monday and Tuesday, June 13 and 14.

Engineering Field Day at Philadelphia.—On Saturday next, June 18, the Philadelphia Sections of the A. I. E. E., the A. S. M. E. and the I. E. S. are to have a joint field day at McCall Field.

Engineers' Club of Philadelphia.—The following officers have been elected by this club: President, William F. James; vice-president, C. N. Lauer; treasurer, Clayton W. Pike; directors-at-large, H. B. Allen and H. F. Sanville.

New York Electrical Society Has Successful Year.—A most successful season was reported by the New York Electrical Society at its annual meeting on June 3. No fewer than 225 new members were enrolled, 171 were dropped, forty resigned and five died, leaving a membership of 770, with ten honorary members and seventy-six life members, or a total of 856. The lecture program of the season attracted the high average attendance of 242, and many exceptionally attractive subjects are already in view for the coming season. The following officers were elected: President, C. G. Young; vice-presidents, F. B. Colt, Ernest Woltmann and O. A. Kenyon; secretary, George H. Guy; treasurer, Thomas F. Honahan.

Coming Meetings of Electrical and Other Technical Societies

National Fire Protection Association—San Francisco, June 14-16.

N. E. L. A., Northwest Division—Portland, Ore., June 15-18. (For program see issue of May 21, page 1180.)

Tri-State Water and Light Association—Asheville, N. C., June 15-16.

Canadian Electrical Association—Quebec, June 15-17. (For program see issue of May 28, page 1265.)

California State Association of Electrical Contractors and Dealers—Santa Cruz, June 16-18.

American Society for Testing Materials—Asbury Park, N. J., June 20-24.

A. I. E. E. Annual Convention—Salt Lake City, June 20-25. (For program see issue of April 30, page 1009.)

N. E. L. A., North Central Division—Duluth, Minn., June 21-23. (For program see issue of June 4, page 1332.)

National District Heating Association—Cedar Point, Ohio, June 22-24. (For program see issue of May 7, page 1069.)

N. E. L. A., Iowa Section—Lake Okoboji, June 22-24.

Association of Municipal Electrical Utilities of Ontario—Niagara Falls, Ontario, June 23-25.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 27-30.

Society for the Promotion of Engineering Education—New Haven, Conn., June 28-July 1.

Ohio Electric Light Association—Cedar Point, Ohio, July 12-15.

National Association of Electrical Contractors and Dealers—Buffalo, July 18-22. (For program see issue of April 30, page 1010.)

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Definition of "Attractive Nuisance."—"Any composition of matter which lures or attracts the confiding ignorance of childhood to its own harm" is, regardless of its lawful character, an attractive nuisance, according to an opinion of the Federal Circuit Court in New York. (271 Fed. 419.)*

City Liable for Injury to Child Who Climbs Elevated Road Pillar and Touches Wire.—Recovery of damages in Stedwell vs. City of Chicago was affirmed by the Supreme Court of Illinois, the case hinging on the city's liability for injury to an eleven-year-old boy who climbed a latticed pillar supporting an elevated railway and came in contact with a high-tension lighting wire. Whether this pillar was an attraction for children so evident as to suggest the probability of accident when an uninsulated wire was placed near it was for the jury to decide, the court held. As regards the city the child was not in the relation of a trespasser. (130 N. E. 729.)

Power Company Cannot Initiate Claim to Reservoir Withdrawn from Entry by Secretary of Interior.—In an action to quiet title, brought by the Verde Water & Power Company against the Salt River Valley Water Users' Association, the Supreme Court of Arizona declared that a certain order of the Secretary of the Interior withdrawing from entry a reservoir site having never been set aside, no valid claim to the lands embraced in such order could be initiated by a water and power company and notices of appropriation posted subsequently by the company were unavailable for such purpose. The laws of the United States in reference to the disposition of public lands are paramount and exclusive. (192 Pac. 227.)

Texas City Ordinance Not a Contract.—In sustaining the finding of the United States Court for the Western District of Texas in City of San Antonio vs. San Antonio Public Service Company (see ELECTRICAL WORLD for April 16, page 895), the United States Supreme Court declared that the city's right to regulate gave it no power to enforce a confiscatory rate unless this power arose from the obligations of a contract. It followed that the solitary question to be considered was whether such a contract existed. Primarily the answer to that question must depend upon whether the ordinance of 1899 fixing the 5-cent fare was a contract. "That it was not, and could not be," said the court, "we are of opinion, is the necessary result of the provision of the state constitution, existing in 1899, prohibiting 'any irrevocable or uncontrollable grant of special privileges,' etc., when considered in the light of the irrevocable and uncontrollable elements which must necessarily inhere in the ordinance of 1899 to give it the contract consequence relied upon." (41 S. C. R. 14.)

Reciprocal Duties of Governments and Owners of Franchises.—In the course of its decision in City of San Antonio vs. San Antonio Public Service Company the United States Supreme Court made the following observations on reciprocal rights and duties: "The duty of an owner of private property used for the public service to charge only a reasonable rate and thus respect the authority of government to regulate in the public interest, and of government to regulate by fixing such a reasonable rate as will safeguard the rights of private ownership, are interdependent and reciprocal. Where, however, the right to contract exists and the parties, the public on the one hand and the private owner on the other, do so contract, the law of the contract governs both the duty of the private owner and the governmental power to regulate." Where the regulating power of the government is wholly uncontrolled by contract, "that power would be required to be exerted, and hence the supposed condition operating upon the private owner would be nugatory." (41 S. C. R. 428.)

Prediction of Proper Rates Must, to Remain Valid, Square with Facts.—In its order dismissing an application made by the city of New York for an injunction against the enforcement of the order of the Public Service Commission increasing the rates of the New York Telephone Company, the New York Supreme Court, Special Term, made this observation: "An order fixing maximum charges when made, like a statute of the Legislature fixing maximum rates, is an attempt 'to predict for future years the charges that will yield a fair return. The prediction must square with the facts or be cast aside as worthless.' It must square with them in one year as in another, at the beginning but equally at the end. In all such legislation from the hour of its enactment there thus inheres the seed of an infirmity which the future may develop. It is the infirmity that always waits upon prophecy; the coming years must tell whether the prophecy is true or false. All that we can say at the outset is that the power to regulate exists. The validity of its exercise depends upon the nicety of the adjustment between forecast and events. This is as true of a regulation which looks forward a year as one which looks forward a decade or a century. In either case, with differences only of degree, there is a forecast of the future which must be justified by the event."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Utility Profits During Business Depression.—The recently expressed opinion of the Public Service Commission of Indiana that a public utility is on a different footing from other kinds of business when faced by the losses incident to business depression and should not be required to forego profits like other corporations (see ELECTRICAL WORLD, June 4, page 1335) is shared by the Washington state commission, which, in a rate hearing concerning the Spokane Falls Gas Light Company, said: "It is the policy of law and of regulatory bodies generally to stabilize public investments. It is to the public interest that the utilities of the country should not be subject to the sharp fluctuations which affect private industries. Public utilities should not be permitted to reap excessive profits nor be compelled to suffer losses which would threaten their existence. Public service concerns should function efficiently at all times. It is to the interest of the public as well as of the utilities that regulation should permit them to earn a reasonable return as well as prevent them from reaping profits which are excessive."

Wholesaling Power Company Allowed to Do Retail Business.—Irrigation Contracts.—The Public Utilities Commission of Idaho has handed down a decision in which five rate schedules of the Ashton-St. Anthony Power Company are approved and one disapproved. The approved schedules allow the company to sell surplus power on a retail basis. In the past its entire business has been wholesale. The schedule disapproved by the commission was the changing of irrigation pumping service from flat rate to metered rate. "The district served is sparsely settled," the commission asserts in explanation of the decision arrived at, "and the irrigation projects therein have only begun their development, and a considerable period of time will be required before this development reaches a stage where its fullest possibilities will be known. The commission has the power and authority to change rates which have been fixed by contract upon a proper showing, but such changes should be made only for good cause clearly shown to exist, as it is only fair for us to presume that when a public utility enters into contracts with its consumers for service it does so with a reasonable knowledge of all the facts and with the expectation that the customer will in his turn, and relying upon such contracts, make investment and plans connected therewith."

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

R. H. Tillman, who was elected chairman of the Commercial Section of the National Electric Light Association at the convention in Chicago last week, has been manager of the new-business department of the Consolidated Gas, Electric Light & Power Company, Baltimore, since 1916. Mr. Tillman has been

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a member of the commercial department of that company since 1909, when he entered the organization as industrial engineer. In 1914 he was appointed superintendent of power sales of the company, and in 1915 the commercial work of the industrial gas department of the company was also placed in his charge. Mr. Tillman is a graduate of the North Carolina College of Agriculture and Mechanical Arts at Raleigh, class of 1906. The two years after his graduation were spent in the testing department of the General Electric Company at Schenectady, and in 1908 he joined the engineering department of the Rochester (N. Y.) Railway & Light Company, being appointed associate engineer of the company in 1909. He has been active in N. E. L. A. work for a number of years.

J. W. Andree has recently been made superintendent of generation for the southern section of the Southern California Edison Company. Mr. Andree will have charge of the principal steam generating stations of that company and of the Eagle Rock substation, which is the terminal substation of the 150,000-volt transmission line from Big Creek. Mr. Andree was born in Germany in 1879 and came to this country late in 1883. He attended the public schools of Illinois and later was employed in the mining industry for seven years. He was graduated from the University of Illinois in electrical engineering in 1907 and then became associated with the Arnold Company of Chicago in general construction work. In 1908 he was employed by the Commonwealth Edison Company of Chicago. He left that employ to become an instructor in electrical engineering in the De Paul University in Chicago. He was employed by the Southern California Edison Company as an engineer in the department of generation in 1910 and has remained with that company up to the present time.

H. A. Von Schon, formerly a consulting engineer at Washington, D. C., has accepted the appointment of court commissioner to regulate water-power operations on the St. Joseph River, with offices at South Bend, Ind. Mr. Von Schon will continue his consulting practice in hydro-electric engineering, public utility valuations, underwriters' reports, water rights and public service legal issues.

R. S. Daniels, who has been on the engineering force of the Washington Water Power Company, Spokane, Wash., for the last fifteen years, has resigned to become assistant to the chief engineer of the California-Oregon Power Company, with headquarters in San Francisco. Mr. Daniels has long been active in engineering affairs in Spokane and was the chairman of the Spokane Section, A. I. E. E., last year.

James Rowland Bibbins has resigned as supervising engineer of the Arnold Company, electrical, civil and mechanical engineers, Chicago, to become manager of the department of transportation and communication of the United States Chamber of Commerce, Washington, D. C. Mr. Bibbins was educated at Baltimore City College and the University of Michigan. He first became engaged in electric and railway utilities work at Detroit. Later he entered the service of the Westinghouse Manufacturing & Electric Company, being engaged in economic research in the development of steam and gas power. In 1909 he became associated with the Arnold Company and since then has undertaken many important engineering investigations and reports for public bodies and various corporations. In his new work he will be in close touch with ocean and inland waterway shipping, steam and electric railroad transportation, cables and telegraphs, postal facilities and roads. Mr. Bibbins has been chairman of the Chicago Section, A. I. E. E., and of the terminal committee of the Western Society of Engineers.

Paul P. Ashworth, who has been elected chairman of the Utah Section of the American Institute of Electrical Engineers, is distribution engineer of the Utah Power & Light Company, Salt Lake City. Mr. Ashworth's first association with the electrical industry was in 1907, when he entered the employ of the Telluride Power Company in Colorado. Later he was associated with subsidiary properties of that company—the Wyoming Electric Company at Casper, Wyo., and the Bear River Power Company in Idaho. When the Telluride Power Company was, with other properties, consolidated into the Utah Power & Light Company organization Mr. Ashworth became associated with the latter company. He was graduated from Cornell in 1914. He is secretary of the

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convention committee of the A. I. E. E. in charge of arrangements for the Institute's convention in Salt Lake City, June 2.

Walter A. Shaw, for seven years engineering member of the Illinois Public Utilities Commission, has opened a consulting engineering office at 30 North La Salle Street, Chicago. Mr. Shaw will handle public utility rate cases and public utility and industrial management.

C. W. Koiner, who for thirteen years has been general manager and mechanical and electrical engineer of Pasadena's municipal light and power department, was appointed city manager of Pasadena on May 2. The new position will invest him with the administration of all municipal affairs other than the library and legal departments.

Robert J. Mailhouse, formerly assistant engineer, motive power department of the Interborough Rapid Transit Company, New York City, has opened offices in New Haven, Conn., and is prepared to make estimates and design and supervise electrical installations. Joseph N. Golding, electrical engineer, joins Mr. Mailhouse in this undertaking. Mr. Mailhouse has heretofore been connected with the Youngstown (Ohio) Sheet & Tube Company and the Stone & Webster Engineering Corporation, Boston.

P. V. Moffat, who has been assistant credit agent of the Southern California Edison Company for some time, has been promoted to the position of credit agent.

T. O. Grisell has become sales manager of the Green Engineering Company, East Chicago, Ind., to succeed Walter S. Burke, who has been appointed New York representative of the company.

R. B. Randall, formerly connected with the Chicago office of the Blaw-Knox Company, Blawnox, Pa., has been appointed manager of the new sales territory in the Southwest, with headquarters in the Interstate Building, Kansas City, Mo.

H. S. Ross, formerly in charge of the record department of the Southern California Edison Company, has been transferred to the right-of-way department, and F. W. Morris has been advanced to the position of record clerk.

E. J. Wood has been appointed manager of the factory control department of the Columbian Enameling & Stamping Company, Terre Haute, Ind. Mr. Wood was formerly connected with the works management department of the Westinghouse Electric & Manufacturing Company.

Karl B. Crawford has been appointed superintendent of the Camaguey (Cuba) Electric Company. Mr. Crawford was formerly superintendent of the Ohio Gas & Electric Company, Leetonia, Ohio. Previous to this connection he was associated with the Electric Railway Improvement Company, Cleveland, Ohio, and the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

R. J. Bravand has been appointed Birmingham (Ala.) district manager of the Hazard Manufacturing Company, Wilkes-Barre, Pa. Mr. Bravand's connection with the Hazard company covers a period of twenty years, partly at the plant and partly in the field. Of recent years he has been service engineer and in that capacity made an intensive study of wire-rope engineering as applied particularly to mine hoisting and haulage.

F. B. Segur has retired as president of the Electrical Manufacturers' Equipment Company with the sale of the business to the Peerless Equipment Company. Mr. Segur became identified with the electrical industry in 1885 as an employee of the Western Electric Company. In 1892 he took charge of the Jenney Electric Company, Kansas City, Mo., and in 1894 became associated with Roth Brothers, Chicago. In 1904 he was made manager of the Northern Wire & Cable Company, and in 1909 he joined the Northern Electric Company in an executive capacity. He formed the Electrical Manufacturers' Equipment Company in 1911 with headquarters in Chicago to manufacture coil-winding tools and allied equipment of his own design, and he had served ever since as president and general manager.

G. G. Shannonhouse, Jr., formerly with the Du Pont Engineering Company, has resigned to become associated with the Industrial Controller Company of Milwaukee as a special factory representative.

Arthur L. Linn, Jr., has been elected vice-president of the United Gas & Electric Corporation of Connecticut, New York City, to succeed T. A. Johnson, who resigned a few months ago. Mr. Linn was formerly treasurer and controller of the company and will continue to fill that office in connection with the vice-presidency.

Jacob A. Kahn, who was recently elected president of the Capital Electric Company, electrical jobber of Salt Lake City, Utah, has served as vice-president and treasurer of the company since March 1, 1918. Mr. Kahn was born July 16, 1872, at Morrison, Ill. He moved to Leadville, Col., in 1880. After several years of banking

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experince he was elected a vice-president of the Baer Brothers Mercantile Company on Jan. 1, 1899, and in January, 1913, he was made president and manager of that company. That position he held until he became identified with the Capital Electric Company. Mr. Kahn is chairman of the advisory committee of the Rocky Mountain Electrical Co-operative League and takes a keen interest in the local affairs of the industry and of the city in general.

Stuart C. Irby has been appointed vice-president of the Cabell-Irby Company, Jackson, Miss., recently organized to conduct a wholesale business in electrical supplies in Mississippi and the northern part of Louisiana. For nearly two years Mr. Irby and T. C. Cabell carried on a retail and construction business. Previous to this Mr. Irby was connected with Henry L. Doherty & Company, New York City, for twelve years, resigning as business manager of one of their properties to go into business with Mr. Cabell, who is a graduate of the Massachusetts Institute of Technology and has had fifteen years' experience in electrical engineering, construction and sales.

Robert B. M. Wilson has been appointed sales engineer of the Chicago district of the Conveyors' Corporation of America, with headquarters at 326 West Madison Street, Chicago. With him will be associated as an assistant E. M. Wolfe.

R. H. Witherspoon has been appointed manager of the Atlanta branch of the R. B. Corey Company, New York City, marine electrical engineers and contractors. He has been identified with the electrical industry in the South for several years, having been connected with the Westinghouse Electric & Manufacturing Company and later with the Atlanta branch of the Western Electric Company.

William R. Cadwell has joined the staff of the Norwood-Noonan Company, contracting electrical and mechanical engineers, Chicago, and will handle industrial and railway electrical installations for the company. Mr. Cadwell for the last four years has been superintendent of the electrical contracting firm of A. S. Schulman. He was connected with the Chicago & Northwestern Railway for nine years, leaving its employ as assistant electrical engineer. He is a member of the American Institute of Electrical Engineers.

C. H. Purdy has been appointed manager of the new Cleveland and Pittsburgh offices which have just been opened by the R. W. Lillie Corporation, 50 Church Street, New York City. Mr. Purdy's headquarters are in the Engineers' Building in Cleveland, from which he will cover the State of Ohio and part of Pennsylvania. After his graduation from Union College in Schenectady, N. Y., Mr. Purdy became connected with the Consumers' Power Company, Jackson, Mich., and he is now leaving the Springfield (Ohio) Light, Heat & Power Company where he has been railway sales engineer.

Richard E. Caldwell of Salt Lake City has been appointed State Engineer of Utah, to succeed George F. McGonagle. The new engineer is a native of Utah and has been identified with some of the most important engineering projects in the West. He is the senior member of the engineering firm of Caldwell & Richards and has been in charge of the Millard County drainage project, one of the largest irrigation and drainage enterprises in the West, the purpose of which is to reclaim 80,000 acres.

Obituary

Karl G. Roebling, president of John A. Roebling's Sons Company, wire manufacturers of Trenton, N. J., died at his summer home at Spring Lake, N. J., May 29, at the age of forty-eight. He had been connected with the wire company all his business life, and since the latter part of 1918 had been the president, having formerly been treasurer of the company. He was a grandson of John A. Roebling, who built the Brooklyn Bridge.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Value of Electrical Exports in April Was $9,085,598

ALTHOUGH the value of electrical exports for the month of April—$9,085,598—is about $700,000 less than that for the month of March, it is nevertheless over $2,000,000 better than the exports of April of 1920. The total to date amounts to $47,833,076, which is $7,000,000 more than the total electrical exports for the year 1916. So far this year the exports are averaging almost $12,000,000 a month, which if continued would bring a record year of more than $143,000,000. The total for 1920 was $102,618,508.

Only two items exported in April were in higher amounts than in the three previous months this year—carbon filament lamps and rheostats and controllers. Carbons, fans, heating and cooking apparatus, interior wiring supplies, meters and measuring instruments, telephones and miscellaneous materials made low marks for this year.

With the general decline of prices over the last few months of 1920 and up to date in 1921, it is not surprising to find the values of sales drop off. If these lower prices affected April sales to an extent of only 10 per cent, still it would put April ahead of March.

The Bureau of Foreign and Domestic Commerce is responsible for the figures in the attached table.

	April		Four Months Ended April	
	1920	1921	1920	1921
Batteries	$487,472	$430,235	$2,080,040	$1,949,722
Carbons	84,967	12,059	429,724	196,802
Dynamos and generators	636,362	569,941	1,877,173	2,524,571
Fans	149,728	120,361	374,164	968,117
Heating and cooking apparatus	140,715	165,962	530,004	1,019,943
Insulated wire and cable	526,556	807,218	2,298,980	5,100,392
Interior wiring supplies	308,091	170,038	902,809	1,169,689
Arc lamps	698	1,927	2,049	7,469
Carbon-filament lamps	11,514	22,602	48,379	66,916
Metal-filament lamps	352,669	384,224	1,355,105	1,898,752
Magnetos, spark plugs, etc	310,744	131,474	1,268,402	707,421
Meters and measuring instruments	181,663	250,913	796,905	1,279,525
Motors	923,096	1,711,620	3,730,451	7,774,078
Rheostats and controllers	66,389	164,745	244,325	527,882
Switches and accessories	272,680	432,487	1,304,550	2,322,417
Telegraph apparatus	44,394	42,590	306,078	551,046
Telephones	326,497	447,530	1,224,591	2,425,777
Transformers	169,976	783,906	1,162,720	3,795,323
All others	960,139	2,435,766	8,823,451	13,547,234
Total	$6,954,350	$9,085,598	$28,759,900	$47,833,076

No General Increase in Prices of Bare Copper Wire

IN LINE with the gradual firming of the copper market over the past few weeks, at least two producers of bare copper wire have increased their base prices to the extent of ½ cent per pound. This is interesting in the light of the prevailing opinion that a rush to buy copper wire will follow a stiff advance of prices. That this increased demand has not materialized, it is thought, is because the copper market does not consistently hold its gains and the advance in base prices by wire producers has not been general. Within the past two weeks spot electrolytic copper touched a high range of 13¾ cents per pound, but it has since receded to a weak 13¼ cents.

At the present time, though base prices are quoted, they do not represent an absolute indication of prices for the reason that the market is so strongly competitive these prices are not strictly adhered to. Among several of the leading producers quotations range in gradations of ¼ cent per pound from 15 to 16 cents. The market remains fully as quiet as it has been over the past few months. Central stations are showing little activity and buying is mostly for maintenance, though it is said that an increase in the number of inquiries from the West is noted. The foreign market is flat and, taken all in all, the outlook seems to point to a very quiet summer.

Producers are reconciled to this, however, and are buying copper from hand to mouth for the most part. Production is down commensurate with buying, and in a number of instances plants are operated only as orders are received. Deliveries can be made promptly and on an average range from ten days to two weeks and even better.

Hopes are now being pinned to the fall months, as it is generally expected that September and October will see a material increase in business in this line.

England's Future in Electrical Manufacture

UNDER the caption "The Future of Electrical Manufacture" Mr. Mensforth, Director-General of Factories, War Office, presents in the annual manufacturers' number of the London *Electrician* for May 20 what he believes to be the possibilities of electrical manufacture in England. He states that the part that electrical engineering will have in the removal of the difficulties incidental to electrical manufacture is dependent upon the vision and courage of the men responsible for its development. The possibilities of electrical manufacture, Mr. Mensforth states, can best be developed by:

1. The education of the general public as to the utility as well as the convenience of electricity.
2. The technical development to the highest state of efficiency and reliability of all apparatus.
3. The better standardization of apparatus to facilitate manufacture.
4. The provision of the best plants and facilities in the factory manufacturing the apparatus.
5. The efficient utilization by all concerned of these facilities up to the fullest extent.

"While much may be done to educate the public as to the possibilities of electricity, especially in the homes, is it sufficiently realized," asked Mr. Mensforth, "that while we have shortened hours and improved the working conditions of all classes of industrial workers we have done nothing to help the ordinary woman in her home? In this direction America is far ahead of us, a condition of affairs very largely brought about by the shortage of and difficulties with domestic help, which has been experienced there for years, a position in which we now find ourselves.

"The whole possibility of domestic electrical apparatus has been changed in the last two or three years by the servant problem, combined with the increasing cost of town gas, and a determined effort should be made to develop and market apparatus suitable to our needs, advantage being taken in its design of any ideas women may have in connection with its use.

"Our future prosperity is intimately associated with the supply of cheap power, the two largest items going to make the cost of power being coal and capital charges."

While Mr. Mensforth gives the electrical engineer credit for improvement in the efficiency of steam prime movers, he believes that he has until recently confined his attention too much to steam consumption in the prime mover and has not paid enough attention to the question of economy in boiler-house and auxiliary plants.

"It is only recently that the country has devoted any real attention to the study and commercial development of insulating materials," says the author, "and very much more will have to be done in this direction if we are to hold our own in the future and further to bring down the cost of much of our electrical apparatus.

"The problem of standardization from the point of view of manufacture of electrical apparatus is a difficult one, inasmuch as all design is a compromise based on the necessity of the individual case, and it is hard to decide whether it is wiser to sacrifice a certain amount of material in a machine to enable a size to be used which is in stock or to put in the exact amount and use special sizes with consequent increased stock and possible delays."

Improved Outlook Reported for Schedule Material Sales

THE outlook for schedule material sales is improving. The gradual resumption of building operations in many parts of the country is a helpful factor in the situation, and some producers of schedule material are now operating at or very near full time. There are still considerable stocks of raw materials on hand. The labor situation within the manufacturing branch is at present favorable. Up to Tuesday night there was no indication of a price decline.

Sentiment among jobbers is in favor of the adoption of net prices by the manufacturers instead of the present general method of applying a discount to an entire schedule. The net price plan, it is stated, would enable the distributer to sell fast-moving material at a lower margin of profit and allow him to place a sufficient margin on the normal and slow-moving lines to carry the burdens of investment and overhead on these products. This allocation of the overhead where it would seem to belong should enable the distributer to handle economically the staple commodities for which the demand is so great, including such articles as key, keyless and pull sockets, plug fuses, combination plug cutouts and service switches. These materials represent in some cases an annual turnover of ten or twelve compared with three or four in the slow-moving lines.

In the sale of No. 14 rubber-covered wire the net price method is reported to be working well, and one of the large manufacturers, it seems, has also been making net prices for some time on schedule material. Representative jobbers assure that they feel this to be to the advantage of the trade as a whole as the net price system means that the jobber would become a more efficient distributer for the manufacturer.

Hot Weather in Some States Brings Out Fan Motor Stocks

THE fan-motor business to date has been quite spotty, depending entirely upon the section of the country canvassed. The Central, Pacific and Southern belts have been the most active, while the New England and Middle Atlantic territories have been comparatively quiet. St. Louis reports heavy sales in fans as constituting the most prominent feature in the electrical jobbing field last week. Abnormally hot weather for the time of year was experienced throughout all of the surrounding territory, and the rush for fans quickly depleted the stocks of those who had cautiously laid in but a small supply. Stocks in the hands of the jobbers have been sufficient to meet this early demand, but movement of fans from the manufacturers is under way. One manufacturer reports a normal business so far this year.

Varied returns are received in Chicago on fan trade. While some jobbers there seem to feel that they will have difficulty in disposing of stocks, certain dealers report excellent business and say they fear inability to fill orders. Excessive heat is reported from southern Illinois and in Iowa, causing good sales in those territories. A feature noted is that while last year's requirements ran largely to household sizes many orders are coming in now for 16-in. and ceiling fans. Cincinnati, too, is one of the bright spots for recent fan movement.

Advices from Atlanta state that the protracted period of hot weather for the past two weeks has finally brought out the buying element, with the result that a very brisk movement of fans is noted, covering both the pedestal and ceiling types. For a time it was thought that fans were moving so slowly the pressure would be too great to hold up the price, but no second reduction has taken place and it is considered the prices will remain steady for some time.

The Pacific Coast States have responded well to early buying, according to certain manufacturers, and the present market there is reported good.

But from the Atlantic, New England and Eastern States the reports are not so good. Sales in New York as a whole are unsatisfactory. Initial orders were small because of heavy carry-overs from last year. While these may have been taken up in fair amount by dealers, the jobbers have held off on their reorders awaiting fan weather. Only moderately warm weather has struck New York to date. From one source of manufacture, however, good sales have been made in the New York territory.

It is felt that a great deal of pressure must be put upon sales of fan motors for residential use. When hot weather comes the commercial and industrial houses will enter the market, but up to the present the public in general at home has continued to suffer in peace.

The Metal Market Situation

THE copper market is weaker in tone despite the improving statistical position. Stocks in the hands of producers were reduced about 20,000,000 lb. last month, it is estimated, and current production continues below consumption. This is offset, however, by the weakness of demand. Domestic purchases are of the hand-to-mouth order, and foreign buying, which has heretofore been the mainstay of the market, has ceased.

This is due in part to a firming of export quotations recently but principally to the unexpected weakness of all foreign exchanges. Sterling this week dropped below $3.80, the lowest mark reached since last January, and this means a lowering of the equivalent price per pound of copper in London. Consequently, foreign consumers have held off placing orders in this country. The large producers are now nominally quoting 13.25 cents per pound for prompt shipment, 13.25 cents for June and 13.50 cents covering July, but these prices are shaded at least ⅛ cent, it is reported.

Zinc has declined to new low levels, and at its present extremely attractive price it is hoped that increased buying will result. Tin has dropped, too, following London prices and foreign exchange rates down. This market is largely speculative and consumers remain conservative, but should the price remain under 30 cents it is possible that consumers will be induced to buy. Lead demand is quiet with ¼ cent drop in price. Several of the scrap metals show slight advances.

NEW YORK METAL MARKET PRICE

	May 31, 1921	June 7, 1921
Copper	£ s d	£ s d
London, standard spot	72 10 0	72 15 0
	Cents per Pound	Cents per Pound
Prime Lake	13.25	13.25
Electrolytic	13.25—13.50	13.12½–13.25
Casting	12.50	12.37½
Wire base	15.00—15.25	15.00—15.25
Lead, trust price	5.00	4.75
Antimony	5.25	5.20
Nickel, Ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	10.00	10.00
Zinc, spot	5.20	5.00
Tin	31.62½	29.50
Aluminum, 98 to 99 per cent	28.00	28.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	10.50—10.75	10.75—11.00
Brass, heavy	5.25— 5.50	5.25— 5.50
Brass, light	4.00— 4.25	4.00— 4.50
Lead, heavy	4.25— 4.40	4.25— 4.50
Zinc, old scrap	2.50— 2.75	2.50— 2.75

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

A GENERAL increase in residential construction is reported from virtually every territory of the country; San Francisco itself is less active than it has been this year, and Chicago, too, has not picked up its accustomed pace. In the latter city, however, the feeling is that the labor difficulties will be over very soon. Commercial building, though, is rather more quiet.

There is an increasing movement of wiring materials in most centers. The jobbing trade is reported as supplying a firm demand that is tending upward in the St. Louis district. Poles and cross-arms are moving in better supply and line hardware has started. Washing machines are selling well there; they are selling well in the Chicago district, and vacuum cleaners are moving where real sales effort is applied. Boston shows an improvement in jobbing trade and washers too are in good demand. Residential and commercial building is becoming better in the South. New York jobbing trade continues quiet, and it is felt that it will stay so for the summer. Schedule material is not moving well there, and the trade asserts it feels the price is too high.

NEW YORK

Some jobbers report that May sales went ahead of the previous month, but others say either that business only held its own or else that it fell off slightly. The general situation is quiet and the trade has settled down to expect a summer of very light business.

Building construction looms up as one of the favorable factors promising future relief to the electrical market. As yet its effect has not been felt, however, and contractors are buying sparingly. Building plans filed during the week of May 14 to 20 inclusive, according to the Dodge reports, represented 572 new buildings, totaling about $17,583,000, of which total 418, or $11,300,000, were for residences. During the same week contracts actually awarded totaled $13,082,000 for 303 new buildings, of which 228, with a value of $9,731,000, were for residential buildings. The territory covered by the above figures is New York State and New Jersey north of Trenton. The outlook afforded by the construction program is somewhat dimmed by the employment situation, however, for in New York City alone at the present time it is reliably estimated that there are 300,000 out of work.

General reductions in the price of dry cells have been made as well as cuts on one or two items of individual manufacture.

A representative jobbing house is circularizing to dispose of a large stock of 16-in. non-oscillating fans at cost. These were carried over from last year.

Metal Molding.—Some jobbers find the market quiet on this item, but others report an active demand. The price of 1,000 ft. of the three-wire to four-wire size of different makes varies from $67.50 to $68.80.

Dry Cells.—General price reductions have just been announced by manufacturers, including "Columbia," "Red Seal," "Everready" and other batteries. In barrel lots jobbers now quote No. 6 regulars at 29 cents each, compared with 36 cents formerly. Igniters are now 30 cents.

Lighting-Fixture Chain.—National Chain Company, College Point, Long Island, has reduced the price of National "Unxld" guaranteed chandelier chain, effective June 1.

Socket Plug.—Ajax Electric Specialty Company, St. Louis, Mo., announces a reduction in list price on its new type of plural socket plugs. No. 22, double, now list for $1 each and No. 33, triple, at $1.25 each. The same discounts still apply.

Porcelain.—Demand shows no life and stocks are well filled, in some cases too much so. Since the reduction on "Nail-it" knobs jobbers quote from $18.37 to $22.50 per 1,000 in barrel lots. Tubes, 3 in. x $\frac{7}{16}$ in., are worth from $8.05 to $10.35, and two-wire unglazed cleats from $18.20 to $35 in the same quantity.

Rubber-Covered Wire.—The market is highly competitive. From $6.50 to $7 per 1,000 is obtained for 10,000 ft. of No. 14 single-braid. Stocks are good and demand small.

Flexible-Armored Conductor.—Price cutting continues but demand, with a few exceptions, is weak. About $55 is nominally asked for 1,000 ft. of No. 14, two-wire, double strip, though at least one house offers a good stock at $53.

Schedule Material.—Buying on the part of jobbers is flat, and they freely state they are holding off awaiting a lower price which they feel is imminent.

CHICAGO

All sorts of reports as to the progress of business have been obtainable this week, some jobbers, manufacturers and dealers reporting excellent business while others say there is absolutely no trade. Trade interest was centered on the N. E. L. A. convention. Industrial conditions remain unchanged, but it looks as though a stop is to be put to the existing labor controversy in the construction industry as both sides are reported as having agreed to arbitration. The tie-up has lasted five weeks and is holding up construction estimated to total close to $100,000,000.

Copper and its products have firmed up considerably during the period, while the downward tendency in the remainder of the electrical line has continued. The wire market was slow to follow the upward turn in copper, but during the past week the large handlers put their price up ½ cent, and it is no longer easy to locate distressed lots at a cent or more under the market.

Motors.—Trade in motors of all sizes remains flat, the general industrial inactivity preventing any demand for other than fill-in purposes.

Washing Machines.—These continue to be the one dependable source of business. The volume of business done is limited only by the sellers' ability to finance long-term payments. Wherever selling activity is a feature sales in pleasing volume are the result, and this seems to be true in regard to the higher-priced standard machines as well as newer and cheaper types.

Vacuum Cleaners.—Business in vacuum cleaners appears directly proportionate to sales effort. Manufacturers who stage selling campaigns in various towns for their distributers' benefit report excellent results from crew efforts even in those cities most affected by the present industrial depression.

Wire.—Weatherproof wire, obtainable from some sources on a 15½-cent base two weeks ago, is now firmly held at 2 cents higher. A leading jobber quotes No. 6 triple-braid at 18½ cents per pound in 1,000-lb. lots. Bare copper wire is up ½ cent to 17 cents for No. 8 in 1,000-lb. lots. In quantity it is possible to shade from ½ to ¾ cent per pound.

Flexible Armored Conductor.—From a weak, uncertain quotation basis last week the market has firmed up considerably in expectation of a resumption in building. The quotation is unchanged at $57.50 per 1,000 ft. for No. 14, two-wire, double-strip, but this quotation is not subject to much variation.

Cross-Arms.—Long-leaf yellow pine cross-arms are reported as taking another drop of about 10 per cent. Quotations are not yet available, but actual figures will be given next week. There is no change in the price of Pacific Coast arms.

Locust Pins.—A reduction of about $5 per 1,000 has just been reported by one large source of supply. The new price, in large quantities, will be about $35 per 1,000; in small quantities, $48.

BOSTON

Business is somewhat spotty at present, although improvement is reported in jobbing circles and building operations are more active. Building and engineering contracts in New England for the week ended May 31 totaled $4,998,200 against $3,218,000 for the same period last year. Gradually the labor situation appears to be getting more favorable. Jobbers are still buying mainly for current demands or a little more. Prices are unsettled in wiring material lines, with a tendency toward an open market on large-quantity quotations. Collections require close follow-up work and considerable caution is evident in granting credit. Deliveries continue easy and the outlook is for a good summer trade in many lines. The Holyoke Water Power Company is going ahead with important local hydro-electric development work and construction work has begun, it is reported, upon the New England Power Company's proposed development on the Deerfield River in southern Vermont. Important hydro-electric work is also under way at Berlin, N. H.

Appliances.—Despite complaints of some dealers that business is dull, other retailers are handling a fair volume of trade. Active sales effort with emphasis upon convenience is yielding good fruit. Washers are moving continuously, and considerable interest is evident in motor-driven ironers. Electrical wedding gifts are coming into prominence this month, but it is too early for results.

Motors.—Beyond spasmodic sales the market shows little evidence of vitality. A good amount, however, of betterment work is being done, and this is absorbing motors in moderate quantities, selected for particular jobs. Prices appear steady for the present.

Flexible Armored Conductor.—This material is weak on quantity sales, prices ranging from $57 to $60 per 1,000 ft. in No. 14 double-strip, 1,000-ft. lots, and lower on sharply competitive sales in fair quantities.

"Nail-it" Knobs.—Prices are soft, the current sales figure being about $21 per 1,000 in barrel lots. Improved building conditions are lightly reflected in the demand, which is still readily handled from local stocks. Porcelain tubes are steady in price.

Wire.—Rubber-covered No. 14 sells around $6.75 per 1,000 ft. in 1,000-ft. lots. Moderate sales are reported, with considerable competition. Weatherproof wire is selling moderately well. Base prices vary a cent a pound or more, with varied additions for size. A representative price to the contractor-dealer of No. 6 in 100-lb. to 200-lb. lots is $21.50 per 1,000 ft. Bare selling prices range around 15½ cents to 16 cents per pound, with light demand. Piecemeal central-station construction work, house wiring and new commercial structure wiring are helping sales.

Lamp Cord.—Easy deliveries and quiet prices prevail. No. 18 cotton-covered cord brings $18 in 1,000-ft. lots.

Storage Batteries.—A temporary recession is noted in demand for automobile purposes within a fortnight. Prices are steady and inquiries in good volume.

Dry Cells.—Prices are easier, a leading make moving for $30.35 per 100 in barrel lots, No. 6 size, and for $31.35 in the ignition type. As yet the demand is nothing striking.

Rigid Conduit.—A better tone is apparent, one leading house having inquiries Monday for two carload lots from different sections of the country.

ATLANTA

Activity in residential and commercial construction is growing each week, as indicated by building permits over the Southeast. Permits in Atlanta for May were considerably greater than for the same period of 1920, and from all reports it appears that a general building revival is slowly taking place in the surrounding states. The textile strike called June 2 has had a dampening effect on industries, but this probably will be of short duration as business in general has discounted the effect of wage reductions. It is felt that the textile situation will be cleared up in the course of a week or two, putting this industry on a more healthy basis. This will help the electrical industry in the increase of business as the industry stabilizes. The report of the Sixth Federal Reserve district for May shows a lull of buying in the rural district, which has in turn tended to slow up wholesale business. The contemplated reduction in discount rate has created an easier tone in the money market and more funds are in the bank for loans on legitimate enterprises. This in itself is one of the bright features at this time.

Industrial Lighting.—While business in this department of the electrical industry experienced a sag along with the rest, the industry as a whole is now devoting more thought to the possibilities of efficient illumination, and this, through the stimulation of lighting experts, has increased business materially. Standard RLM reflectors showed a reduction in price of approximately 10 per cent this week. Jobbers' stocks are well filled and manufacturers are not receiving many large orders.

Dry Batteries.—Regular dry cells dropped 7 cents each this week, due no doubt to the slackening in demand at this time of the year. The demand for dry cells for several months past has been very weak.

Vacuum Cleaners.—Efforts on the part of jobbers and dealers to turn over the heavy stocks of cleaners has resulted in sales stimulation, and it is fully expected that fairly good business will be experienced as the season advances. No price change is to be noted.

Insulating Materials.—Jobbers and manufacturers have noted the insistent call lately for repair material of all descriptions, this being brought about by industrials renovating during their shutdowns and endeavoring to utilize old equipment rather than go into the market at this time for new equipment.

Electric Drills.—The market for this specialty opened up briskly last week, but it is felt that this is sporadic and that the demand will not be sustained.

Heating Devices.—The demand was stimulated somewhat last week through the Hot Point campaign but has slumped off again this week, with the exception that flatirons and curling irons seem to be moving fairly well.

Electric Auto Accessories.—Nearly all items under this head are dormant and have been for some time, but spotlights and miniature lamps show some improvement.

Fixtures.—Dealers report a good demand for moderate-priced fixtures for residential work. It is expected that the demand will hold up fairly well throughout the summer and fall, in view of the present residential building program.

ST. LOUIS

The demand for most electrical goods has remained firm, with a tendency toward gradual growth, and it can be said that the jobbers view even the immediate future with entire confidence. Stocks, as a rule, are in satisfactory condition, there being few overstocks reported and the general tendency being to keep them at a minimum. As industrial buying is almost entirely for maintenance purposes, the contractor-dealers are loath to stock any appreciable quantity of industrial equipment. In schedule materials a fairly general overstock seems to prevail. One price change for the week is reported, namely, a reduction of about 15 per cent in dry cells. Credit conditions are unchanged, the average basis being from forty-five to sixty days. Money is somewhat easier to obtain.

Industrial building is still at a very low ebb, but the indications are that one or two large enterprises will be started in the next sixty days. Announcement is made of the commencement of construction on a five-million-dollar group of buildings for hotel and apartment purposes. The building wage situation is unchanged, but some express a hope of lower wages after July 1 as a number of the labor contracts expire on that date.

Dry Cells.—Effective June 1, a price reduction of approximately 15 per cent was made. In barrel lots the regular cell is now quoted at $31 per 100 and the igniter at $32. The demand is quite satisfactory over the entire territory and stocks are reported in excellent condition.

Fans.—A heavy retail demand continued last week, ex

hausting the stocks of many retailers who have been wiring jobbers for rush replacements. Jobbers had fairly good stocks in most instances but are asking for deliveries of their orders on factories. One large manufacturer reports that the demand so far this year, while not equal to that of last year, can nevertheless be considered as normal.

Poles and Cross-Arms.—One jobber reports a good business in these items for the week. This appears to be unevenly distributed. The demand is primarily for small extensions to distribution systems rather than for major transmission lines. Representative quotations on 3¼-in. x 4¼-in. Rainier fir arms, in lots of 1,000 linear feet, f.o.b. St. Louis, are: 3-ft., $42.53 per 100; 4-ft., $56.70; 5-ft., $70.68; 6-ft., $95.05.

Pole-Line Hardware.—A fairly good demand is found in keeping with that for poles and cross-arms. Stocks are reported on a conservative basis.

Wire.—The demand remains fairly quiet, the only kind selling in any appreciable quantity being No. 14 rubber-covered. The price for it varies from $6.50 to $7.25 per 1,000 ft. in 5,000-ft. lots. One jobber quotes a standard grade at $6.95 per 1,000 ft. in 100.000-ft. lots. The same jobber quotes the base on bare copper at 15¼ cents and that for weatherproof at 16 cents. Stocks are in reasonably good condition.

Tape.—Rubber and friction tape are being sold in gradually increasing amounts with the demand not far from normal. Stocks are in good shape locally.

Magnet Wire.—There is practically no demand and jobbers' stocks are being kept at low inventory. One jobber quotes on a 17-cent base.

Washing Machines.—A good demand continues over the entire territory, particularly toward the South, and it is reported that the call is principally from the smaller towns. A healthy stock is maintained by all of the jobbers.

SEATTLE—PORTLAND

Business generally in Seattle and the Puget Sound district remains sluggish, with no particular indication of improvement in sight. Retailers report washing machines, flatirons, electric tableware, etc., moving fairly well, but jobbers as a whole report business very poor. Collections are reported as showing little improvement. Residence building on a considerable scale is keeping up in the Sound cities, but construction involving big investments is being held up by lack of funds. In Seattle this is particularly true, and a number of construction jobs involving several million dollars are held up.

The employment situation shows improvement from week to week with resumption of activities in the lumbering and logging industries and increased call from agricultural districts. Employment in the Puget Sound cities is still a problem because of the slow resumption of manufacturing and industrial activities and a tendency to keep the overhead to a minimum in all lines. Domestic help is becoming easier to obtain, and there is also noted somewhat improved efficiency of the workers. Jobbers report that this condition is resulting in a stimulation in sales of washers.

Portland jobbers report business for the past week as rather slow, but prospects for the coming week look considerably brighter. The price change for the past week is a slight reduction on rubber-covered wire. Residence building activities are reflecting themselves in increased demand for wire and house-wiring equipment. Credits and collections are not showing any appreciable improvement.

Farm Plants.—While jobbers throughout the district report sales of farm plants considerably below last year, the indications for fall business are still more or less bright. Conditions which are holding back this movement can be summed up in three factors—failure of farmers to dispose of last year's crop, belief that prices of plants will drop, and uncertainty of the future market for farm products.

Electric Tableware.—June wedding gifts are creating a spurt in buying of percolators, chafing dishes, toasters and table stoves, the majority of this business developing through the department stores and gift shops.

Ranges.—These continue to show little movement owing to the high price and the determined stand of the public to wait for a reduction.

Fuses.—Plug fuses in the 5, 10 and 15-amp. sizes are moving fairly well on account of increased activity in residence construction. The movement in cartridge fuses remains light. Stocks are in good shape and prices fairly stable.

SAN FRANCISCO

Members of the San Francisco Building Exchange state that business will have been resumed by June 13 on the American or open-shop plan, and that they are assured by local employment bureaus of a sufficiency of workmen for outstanding jobs in case the unions composing the local building trades council do not accept re-employment at the 7½ per cent reduction advised by the arbitration board. Oakland and the other Bay cities, which have followed the lead of the San Francisco contractors, expect to put the same plan in operation at the same time. In return the local unions have appealed to the district attorneys of San Francisco and Oakland, preferring charges of conspiracy in restraint of trade against the respective builders' exchanges of those cities. The strike is reflected in the value of building permits issued. The figures for May, 1921, being: San Francisco, $1,097,151; Oakland, $1,033,-323, as compared with respective figures of $3,879,060 for San Francisco and $957,679 for Oakland, in May, 1920. In southern California, on the other hand, building is proceeding at a rate which nearly doubles the remarkable figures set for last year. The value of building permits issued in Los Angeles for May, 1921, was $7,433,760, as compared with May, 1920, figures of $3,160,300.

Fixtures.—Because of the building stagnation in the bay district fixture manufacturers are reporting a very poor business and jobbers who handle unit fixtures find their stocks to be slow-moving.

Ranges.—The Great Western Power Company has approximately 60,000 additional horsepower to deliver from its Caribou installation and is planning an intensive electric range campaign in the near future. Various types of ranges are now under consideration, and the actual purchase will be consummated within the next few days.

SALT LAKE CITY—DENVER

Judging from the steady increase of building permits being issued, construction work is picking up in a satisfactory way. The month of May showed an increase in percentage over the month of April. This big gain is evidence both of the easing of money and of the belief in many quarters that economic conditions are now sufficiently stabilized to permit at least the most pressing construction work. It is significant that by far the greatest number of permits are issued for the building of homes. A fully equipped electrical home in process of construction in Salt Lake City will be ready for demonstration by Sept. 1.

Ironers.—The sales of ironers are incidental and scattered, and the business has not yet reached a stabilized or regular state. Thus far, it is felt, the price forbids the extensive home use of ironers.

Sewing Machines.—For some reason sales have shown a remarkable increase in the past few months. Dealers are furnishing an outlet and making frequent calls on their jobbers. The several popular makes sell at $75 to $125.

Meters.—The type most in demand in this territory is the 5-amp., 110-volt. Prices are quoted at $25 to $30 and stocks are good.

Electric ranges.—A special price concession by a prominent manufacturer stimulated a temporary demand and resulted in a number of sales. The potential demand is big, and sales on a large scale are waiting on lower prices.

Wire.—The wire market is at a low ebb. Apparently it will require more than price cutting to stimulate a demand. Rubber-covered wire is now on a 16-cent base and weatherproof is 17 cents. Jobbers are overstocked with no relief at present in sight.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Keystone Ironing Machine Puts Headquarters in New York

The main and executive offices of the Keystone Ironing Machine Company have been removed from Pittsburgh to the Knickerbocker Building, Broadway and Forty-second Street, New York City. Under the new management the company plans to acquire its own manufacturing plant and connections are now under way for that purpose. The new officers are: Leo Potter, president and general manager; Sol Finkelhor, vice-president; Mark Schiller, secretary and treasurer; F. G. Jarabin, sales manager, and R. J. Mompere, chief engineer.

Gagen & Becker Formed in New York City

James M. Gagen has joined with Elvin J. Becker in the establishing of the firm of Gagen & Becker, electrical contractors and engineers, 750 West One Hundred and Eighty-first Street, New York City.

Mr. Gagen has been identified with the electrical contracting business in New York City for the past fifteen years, being the founder and president of Gagen & Butler, Inc., from which office he has recently resigned.

Mr. Becker has been engaged for fifteen years on large engineering and construction operations throughout the South and Middle West of the United States. Both men are technical graduate engineers with extensive experience.

Mica Insulator Company Wins in Trade Mark Suit

The Mica Insulator Company, 68 Church Street, New York City, announces that it has recently won a suit it brought last year against the Mica & Micanite Supplies Corporation, subsidiary of an English company, for infringement of its registered trade-mark "Micanite," which it has used for twenty-eight years to identify its built-up mica insulation, and for unfair competition because of the use of that trade-mark as part of the corporate name of the Mica & Micanite Supplies Corporation. Judge Knox of the District Court of the United States for the Southern District of New York has entered a decree sustaining the position of the Mica Insulator Company in all respects, ordering that the defendant corporation be enjoined from using the word "Micanite" in any way in connection with the sale of electrical insulation, even as a part of its corporate name

The demand for micanite has been so great that the company has been forced to expand its manufacturing facilities several times in the last few years. Five years ago a new factory was erected that more than doubled the manufacturing output at that time. A year ago an addition to the factory was erected, then increasing the capacity 50 per cent.

Walker Electric Vehicle Men Hold Convention

The sales staff of the Walker Electric Vehicle Company, whose home offices are at Chicago, held a convention of one day last week during the N. E. L. A. gathering in that city. About fifty attended and G. A. Freeman, vice-president, was in charge. The new factory of the company was inspected, and during the business sessions considerable optimism was expressed regarding the outlook for electric truck sales within the economic field of service to which this class of equipment is adapted.

Westinghouse Opens New House in Cincinnati

The Westinghouse Electric & Manufacturing Company has greatly increased its facilities in the Central States by moving into its new headquarters at Third and Elm Streets, Cincinnati, Ohio. All the business of this company, the Westinghouse Lamp Company and the Westinghouse service department in this district, which comprises the major part of Ohio, all of Kentucky and Indiana, of which James A. Brett is the manager, will be handled from the local headquarters. The building contains four floors and basement for the use of warehouse, lamp, service and office departments. It is so constructed that additional stories may be added as the business in this district expands.

Stoker Manufacturers' Convention Program Outlined

The Stoker Manufacturers' Association will convene for its summer meeting at the Red Lion Inn at Stockbridge, Mass., June 14, 15 and 16. During the sessions E. H. Sniffin, Westinghouse Electric & Manufacturing Company will outline the manner of handling stoker business in the past and at present. Harry E. Cleland, Philadelphia, will outline the advertising and publicity requirements of a typical stoker company and how this money should be spent, and the various committee chairmen will present their reports.

For the commercial committee, P. A. Poppenhusen chairman, the discussion will take in the advisability of reorganization of standing and other committees and the advisability of establishing a research committee for certain lines of work. For the publicity committee, R. C. Beadle chairman, a national advertising campaign will be discussed. The engineering committee, John Van Brunt chairman, has several topics for presentation, including new uses of stokers, etc. The A. S. M. E. conference committee, Loyd Stowe chairman, in its report will discuss the work of the recently created fuel sections of the professional section, and the A. S. M. E. revision of the power test codes. One of the topics for the membership committee, J. G. Worker secretary, will be the advisability of extending the association to include semi-automatic shaking grate manufacturers on some membership plan.

Arrangements have been made for golf and other forms of recreation and entertainment between the scheduled sessions.

Warehousers and Distributers to Convene Next Week

Traffic representatives of manufacturing companies which distribute their products through public merchandise warehouses will meet in convention at the William Penn Hotel, Pittsburgh, on June 16 and 17, under the auspices of the Shippers' Warehousing and Distributing Association, which was organized at Chicago a year ago for the general purpose of effecting standardization of forms, practices, rules and regulations in the business relationship between manufacturers and the public warehouse industry. The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., and the De Laval Separator Company, Chicago, are among the members of the association. Details regarding the convention may be obtained by addressing Kent B. Stiles, 239 West Thirty-ninth Street, New York City.

Federal Sign's Report for Fiscal Year 1920

The Federal Sign System (Electric), 8700 South State Street, Chicago, has added $200,415 net income to its surplus as the amount by which its revenue from all sources for the year ended Dec. 31, 1920, exceeded its expenses. This leaves a surplus as of Dec. 31, 1920, of $759,837. More than $88,000 was deducted for depreciation of the plant and sign investment. Income from all sources amounted to $5,524,844. Inventory of merchandise, raw material and supplies amounted to $952,693 and accounts were receivable to the amount of $1,153,282.

During the year the new building at Eighty-seventh and State Streets was

completed, and it is now occupied by the company for the Chicago factory and for general offices. It is believed that with the return of normal manufacturing conditions the operations of the company can be conducted with greater efficiency and economy than formerly.

The requirements of business during the year made the employment of additional capital necessary. There was a decided expansion in the sign-renting business and a consequent demand for new capital. Additional capital was also required in the manufacturing and jobbing portion of the company's business. It became necessary to carry a larger stock of merchandise to meet an increasing demand, and it was imperative that new machinery and other factory equipment be installed. Consequently the board of directors authorized an issue of $1,000,000 7 per cent ten-year debenture bonds, $800,000 of which has been used for the above purposes.

There was an actual increase in gross sign rental revenue in 1920, as compared with 1919, of 36.9 per cent.

Westinghouse Campaign of Education on Meters

The San Francisco district office of the Westinghouse Electric & Manufacturing Company has prepared a lecture accompanied by lantern slides covering the history and best practices of installing meters. All of the common types which are in general use are covered, and a brief discussion of their development, installation and operation is given. Of the 125 slides exhibited a number are devoted to the application of outdoor instrument transformers during typical installations. Proper and improper methods of meter installation are shown to illustrate the new rules which are expected soon to be put into effect to govern meter installations in California.

Walter Truck Offers New Electric Vehicle

The Walter Motor Truck Company, 227 West Sixty-first Street, New York City, producer of gasoline trucks since 1909, has entered the electric field and has developed a model of electric road truck from 1,500-lb. and 1-ton sizes to 2, 3½, 5 and 7-ton heavy-duty sizes. Interchangeability of parts throughout between the gasoline and electric trucks is an important feature of these vehicles.

The company has recently gone through an extensive reorganization, and new interests have become identified with it. The electric truck production is in charge of George W. Wesley, formerly vice-president and production manager of the General Vehicle Company. William Walter is vice-president and Maurice Walter chief engineer.

With the enlarged manufacturing schedule there came a necessity of determining a definite sales policy, and it was decided to turn the electric truck end of the business over to Fink-Dumont-White, Inc., 405 Lexington Avenue, New York City, that company agreeing to take over the entire production of the factory.

Fink-Dumont-White, Inc., is comprised of F. B. Fink, president, a former member of the General Vehicle Company sales organization; R. Duval Dumont, vice-president, also a former member of the G. V. C., and W. W. White, treasurer, formerly district manager of the G. V. C. Messrs. Fink, Dumont and White plan to place distributers and agents of Walter trucks, both gas and electric, throughout the country as well as to arrange the proper representation in foreign countries. The metropolitan territory is being covered directly from their own offices.

Mesco's 1920 Surplus Given as $1,239,891

From the balance sheet as at Dec. 31, 1920, of the Manhattan Electrical Supply Company, Inc., New York City, there was a surplus of $1,239,891.80, the sheet balancing at $7,466,246.66. Accounts receivable amounted to $754,248. Inventories of raw materials and work in progress came to $1,246,409 and inventories of finished stock to $1,520,965.

Change in Name for Esterline Company

The Esterline-Angus Company is the new name of the former Esterline Company, Indianapolis, Ind. The original company was organized in 1900 by J. W. Esterline and incorporated six years later. In 1910 D. J. Angus became associated with Mr. Esterline in a consulting engineering business, and in 1917 he became a stockholder and director of the Esterline company. Two years ago these two men bought the interests of all other stockholders, and in view of their long association in both engineering and manufacturing work they have decided to change the name of the manufacturing company to that given above.

There will be no change whatever in the general policy of the company, it is announced. Mr. Esterline will continue to be the executive in charge of sales promotion and advertising, and Mr. Angus will similarly direct the work of production and engineering.

Three new instruments have just been announced, a graphic kva. meter, a graphic alternating-current ohmmeter and a portable concentration meter.

York Jobber Moves and Adds Appliance Department

A department of electrical household appliances has been added to the business of Harry W. Motter, electrical sales engineer of York, Pa., and the removal of his office and storeroom to 335 West Market Street is announced. With these changes Mr. Motter expects to be able to render still more satisfactory service.

Better Business Being Booked by Hi-Voltage

The Hi-Voltage Equipment Company, Cleveland, according to L. C. Hart, president and general manager, is experiencing a better demand. The company is booking new customers and old customers are again buying. Quite a few inquiries have been obtained from abroad. The exchange rate, however, is holding this trade back. Mr. Hart says that he finds the American bankers very anxious to help out in this situation. His company recently secured a large order at current prices for Australia on the basis of sterling exchange established through London. The transaction will be handled by a Cleveland bank. With sixty days for shipping and 120 days credit, it is expected that sterling exchange will probably have improved. Mr. Hart is convinced that trading on sterling exchange, and not dollars, gives the best results.

The Gas & Electric Supply Company, Norfolk, Va., has filed notice of increase in capital stock from $15,000 to $50,000.

The Biscayne Electric Supply Company, Miami, Fla., is considering increasing its capital stock from $25,000 to $100,000.

Pass & Seymour, Solvay, N. Y., has filed notice of increase in capital stock from $300,000 to $1,500,000.

The Edison Fixture Company, 332 Broadway, New York City, has filed notice of increase in capital stock from $2,000 to $100,000.

Allan V. Garratt, hydraulic engineer, formerly chief engineer of the Lombard Governor Company and more recently consulting hydraulic engineer to Lockwood, Greene & Company, engineers, has established an office at 176 Federal Street, Boston, for consultation and advisory work in hydraulic engineering.

The Howard-Geeseka Company, 802 Plymouth Building, Minneapolis, has been appointed representative of the Condit Electrical Manufacturing Company, Boston 27, and will handle the complete Condit line in the States of Minnesota, North Dakota and South Dakota and the northern peninsula of Michigan.

The Schiefer Electric Company, 614 City Bank Building, Syracuse, N. Y., has been appointed to represent the Condit Electrical Manufacturing Company, Boston 27, and will handle its complete line of products in the vicinity of Syracuse and the eastern part of New York State exclusive of New York City.

The Combustion Engineering Corporation, 43 Broad Street, New York City, announces the removal of its Philadelphia office to the tenth floor, Finance Building, Philadelphia, where it has much larger quarters. The development of its business in the Philadelphia district has necessitated an increase in the sales organization of the company and the inauguration of a new service department. W. C. Stripe is manager of the Philadelphia district.

Foreign Trade Notes

THE LYONS (FRANCE) FAIR TO BE HELD IN OCTOBER.—The autumn meeting of the Lyons Fair will be held from Oct. 1 to 15 at Lyons, France. It will be of international character as all foreign articles and products will be admitted. Special attention will be given for the promotion of international trade. American manufacturers may obtain further information on application to Emile Garden, 150 Nassau Street, New York City, which is the head office of the fair in the United States.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT IN FRANCE.—The French government, Vice-consul Corbitt at Lyons reports, is now considering the division of the country into districts for the development of hydro-electric power. As it will take some time for the completion of the government plans, an organization has been formed to be known as the Société de Transport d'Energie des Alpes which will insure further exploitation of resources in this region, and is intended to utilize the power from the many undeveloped waterfalls in the valleys of the Upper Isere and the torrents of the Alps. To the first line of this system will be connected the plant now under construction at La Viclaire, near Lyons.

NEW HYDRO-ELECTRIC PROJECT FOR THE PHILIPPINES.—According to the Bulletin of the Philippine Government Commercial Agency, plans are well under way for a hydro-electric development on the Abo-Abo and Tiawir Rivers, designed to furnish electricity for lamps and motors in the provinces of Bataam and Pampamga, comprising a population of about 48,000. It is estimated that 200 hp. can be developed on each river.

POSSIBLE ELECTRIC PROJECT FOR ASIA MINOR.—The National Assembly of the Angora government, according to a report from Assistant Trade Commissioner Gillespie at Constantinople, has authorized the construction of a railway from Sivas to Samsun on the Black Sea. It is quite possible that sufficient water power may be developed from the Kizil Irmak River to permit the electrification of this railroad, which will be less than 200 km. in length. As yet no equipment has been purchased nor has contract for construction been placed.

WIRELESS STATION IN COLOMBIA FINANCED BY MARCONI COMPANY.—The Governor of the Department of Norte Santander, Colombia, according to Commerce Reports, has corrected the impression that the wireless station at San José de Cucuta is being constructed with goverment funds by issuing the statement that its financing has been undertaken by the Marconi Company.

CONCESSION GRANTED FOR BRAZILIAN WIRELESS STATIONS. — The Companhia Radiographica do Brasil by a decree of March 7, 1921, has been granted a concession to install and operate high-power radio stations for direct communications with the Americas and Europe. The first two stations are to be established in the cities of Rio de Janeiro and Belem, in Para. The concession, which is for a period of forty-five years, grants no monopoly or privilege of any kind and restricts operations to international service, communications between localities within the national territory being prohibited.

REVISED LIST OF IMPORTERS OF ELECTRIC MACHINERY IN CHINA.—The Bureau of Foreign and Domestic Commerce list of importers and of dealers in electric machinery and supplies in China has been revised by the Far Eastern Division with the most recent information available, and is now ready for distribution under reference number FE-13,026-A.

NEW ELECTRIC RAILWAYS IN JAPAN.—The Mushashi Electric Tramway Company, recently organized, according to the Japan Advertiser, will construct and operate a new electric railway from Tokyo to Yokohama, running approximately 11½ miles inland from the present railroad. The company will also furnish electricity to the villages along the rounte. Plans are being made, according to a translation from the Nagoya Shimbun, for the construction of a railroad between Nagoya and Yamada, a distance of 61 miles. Power is to be supplied by the Ibugawa Electric Power Company. Another line 30 miles long, around the Chita Peninsula, is planned by a company to be capitalized at 4,000,000 to 5,000,000 yen. A translation from the Osaka Mainichi Shimbun reports a project for the construction of an electric railway between Nagoya and Gifu. It is proposed to construct a double-track line parelleling the present steam railway, at a cost of about 7,000,000 yen. A line between Gifu and Ogaki is also planned.

CHIEF ELECTRICAL ENGINEER OF AUSTRALIA TO INVESTIGATE AMERICAN TELEPHONE AND TELEGRAPH SYSTEMS.—Trade Commissioner Ferrin reports that F. Golding, chief electrical engineer and director of radio services of the Commonwealth of Australia, has left for a visit to the United States, Canada and Great Britain to inquire into telephone, telegraph and wireless developments in all phases of plant, communication and intercommunication of systems.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A mercantile firm in Canada (No. 34959) desires to purchase washing machines.

Bids are invited by a country in the Near East (34,951) for the construction of docks, quays and an additional warehouse and the installation of two electric cranes.

TENDERS ASKED FOR MATERIAL FOR MORWELL (AUSTRALIA) POWER SCHEME.—Tenders will be received by R. Liddelow, secretary State Electricity Commission, Victoria, 673 Bourke Street, Melbourne, Victoria, Australia, until Aug. 14, for material for the Morwell power scheme covering steel work for power-station buildings, water-tube boilers, stokers, fans, etc.; platforms and ladders, steel chimneys, flues and dampers and dust extraction equipment and ash-handling equipment. Copies of tenders, specifications, etc., may be obtained at the following offices of the Bureau of Foreign and Domestic Commerce: 734 Custom House, New York City, and 1424 First National Bank Building, Chicago.

New Apparatus and Publications

ELECTRIC WATER HEATERS.—"Hot Water by Wire" is the title of a recent publication issued by the Automatic Electric Heater Company, Warren, Pa., decribing its new D type Sepco automatic electric water heaters.

PORTABLE CONCENTRATION METER.—The Esterline-Angus Company, Indianapolis, has developed a portable concentration meter for showing the degree of concentration of chemical salts in water.

STEAM TURBINES.—Bulletin No. 42,019 of the General Electric Company is on the Curtis Steam Turbines for mechanical drive.

SYNCHRONOUS CONDENSER. — The General Electric Company has issued Bulletin No. 41,311 A, superseding No. 41,311, on its standardized line of 60-cycle synchronous condensers.

MULTI-PHASE RENEWABLE FUSE. —The Federal Electric Company, Chicago, has developed a multi-phase time-limit renewable cartridge fuse designed to prevent polyphase motors running single-phase.

BUS AND BOARD FITTINGS—The Erie Electrical Equipment Company, Inc., Johnstown, Pa., has issued supplementary bulletins on split porcelain insulators, wall and floor flanges and main castings for three-way and four-way pipe combinations.

AUTOMATIC STARTER. — The Cutler-Hammer Manufacturing Company's new alternating-current automatic starter is described in bulletin 9604, just issued.

RELAY. — Bulletin 10,081, superseding 10,080, covers the new phase-failure and reversal protective relay of the Cutler-Hammer Manufacturing Company, Milwaukee.

INDUSTRIAL TRUCKS.—The Atlas Car & Manufacturing Company, Cleveland, has put out a new line of storage-battery trucks and tractors with interchangeable units.

FLASHLIGHT.—The American Eveready Works of National Carbon Company, Inc., Long Island City, N. Y., has put out a new line of three-cell flashlights.

MOTORS. — Bulletin 202 describes the Ohio ball-bearing splash-proof induction motors and direct-current motors of the Ohio Electric & Controller Company, Cleveland.

SPACE HEATERS.—Space heaters for commercial and domestic heating are discussed in a leaflet, 3442, just issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

WASHING MACHINE. — The Minier Manufacturing Company, Inc., Minier, Ill., is putting on the market a new washing machine under the trade name of "Elite Electric."

HEADLIGHTS. — The Electric Service Supplies Co., Philadelphia, Pa., has issued a limited number of copies of its new engineering report, No. 351, on glass reflectors for headlights.

FUSED ENTRANCE SWITCH. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently placed on the market a fused entrance switch rated at 100 amp. and 2,500 volts.

INCLOSING STRUCTURES. — Inclosing structures with outside operation for manual and automatic starters are shown in the Cutler-Hammer Manufacturing Company's new bulletins recently issued.

New Incorporations

THE ACE BATTERY MANUFACTURING COMPANY, Brooklyn, N. Y., has been organized by L. P. Mendham and E. Klein, 44 Court Street, to manufacture storage batteries and other electrical equipment.

THE KEHRER DISTRIBUTOR COMPANY, 175 Smith Street, Perth Amboy, N. J., has been incorporated with a capital stock of $125,000 to manufacture and deal in electrical goods and machinery. The incorporators are C. Kehrer, Frank Koch and Emil Stremlau.

THE DELHI POWER COMPANY, Nevada City, Cal., has been incorporated by Fred Searls and Carrol Searls, Nevada City, and Harry B. Skewes. The company is capitalized at $300,000 and proposes to erect a power plant on the Middle Fork of the Yuba River at a point near the Delhi Mine to supply electricity for mining purposes and commercial use.

THE GEM (IND.) ELECTRICAL SERVICE COMPANY has been incorporated with a capital stock of $40,000 to supply electricity for light, heat and power purposes. The directors of the company are F. M. Thomas, W. E. Heller, G. C. Sander, J. A. Resener and W. A. Resener.

THE BROCKWAY LIGHT, HEAT & POWER COMPANY, Brockwayville, Pa., has been incorporated with a capital stock of $50,000 to operate a local light and power system. M. E. Keys is treasurer.

THE NEW ENGLAND SIGNAL REFLECTOR COMPANY, Boston, Mass., has been incorporated to manufacture electrical signaling equipment. The officers are Dudley M. Holman, president, and William H. MacDowell, 47 Liberty Street, East Braintree, treasurer.

THE RITCHIE COMPANY, Worcester, Mass., has been incorporated by William A. Ritchie, Sr., William A. Ritchie, Jr., and Harry A. Wheeler. The company is capitalized at $50,000 and proposes to manufacture and deal in storage batteries.

THE INDEPENDENT CONTRACT MANUFACTURING COMPANY, Union, N. J., has been incorporated by Clemens A. Laise and Albert J. King, Weehawken. The company is capitalized at $100,000 and proposes to manufacture electrical equipment.

THE MODERN ELECTRICAL SUPPLY COMPANY, Newark, N. J., has been incorporated by William Locke and Max Schoether. The company is capitalized at $50,000 and proposes to manufacture electrical products.

THE SUPERIOR INCANDESCENT LAMP COMPANY, 593 Ogden Street, West Orange, N. J., has filed notice of organization to manufacture electric lamps. Philip H. Harrison, 27 Babcock Place, is interested in the company.

THE F. & L. BATTERY & SUPPLY COMPANY, Trenton, N. J., has been incorporated by Charles Fishberg, Rubin Feldsher and Jacob Lens. The company is capitalized at $100,000 and proposes to manufacture electric batteries and other electrical products and is represented by Forman & Levy, 817 Broad Street.

Record of Electrical Patents

Notes on United States Patents

(Issued May 10, 1921)

1,377,915. SAFETY SHOT FIRER; Charles F. Oaka, Lovettville, Alberta, Canada. App. filed April 29, 1920. For use in mines and quarries.

1,377,939. PORTABLE BURGLAR ALARM; Samuel Sundel, New Haven, Conn. App. filed Oct. 2, 1919. For convenient attachment to door or window.

1,377,940. SOUND CONCENTRATOR FOR TELEPHONE TRANSMITTERS; Elmer E. Taylor, Loogootee, Ind. App. filed Sept. 23, 1919. For the deaf.

1,377,951. ELECTRIC FURNACE CONTROL; Alfred L. Wilkes, Los Angeles, Cal. App. filed June 17, 1919. Electric dental oven.

1,377,972. SPLICING EAR FOR OVERHEAD TROLLEY WIRES; Ralph Rose and Nicholas F. Cimaglia, Mount Vernon, N. Y. App. filed July 16, 1919. Removable wearing edge.

1,377,952. HEAT CONTROL FOR ELECTRIC FURNACES; Alfred L. Wilkes, Los Angeles, Cal. App. filed Aug. 2, 1919. Dental oven.

1,377,995. STORAGE BATTERY; Theodore A. Willard, Cleveland, Ohio. App. filed Aug. 7, 1916. For cross-connecting adjacent cells.

(Issued May 17, 1921)

1,378,010. MOTOR CONTROLLER; Charles E. Carpenter, New York, N. Y. App. filed Oct. 5, 1916. Variable speed by field regulation.

1,378,011. TELEGRAPH REGISTER RECEIVING APPARATUS; Nathaniel B. Cregier, Chicago, Ill. App. filed Feb. 11, 1918. For reporting and displaying market news.

1,378,012. ELECTRICALLY HEATED HAIR-WAVING DEVICE; Marie J. Cully, Chicago, Ill. App. filed March 18, 1920.

1,378,019. PHASE-BALANCING SYSTEM; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed May 7, 1917. Polyphase transmission system.

1,378,041. PROCESS OF MANUFACTURING BICYCLE FORKS; Elmer M. Lewis, Dayton, Ohio. App. filed Sept. 2, 1919. Electric butt welding.

1,378,049. CURRENT-COLLECTING DEVICE; Chester B. Mills, East McKeesport, Pa. App. filed Oct. 24, 1917. Collector rings for alternating-current motors.

1,378,066. APPARATUS FOR HEATING LIQUID HYDROCARBONS IN DISTILLING AND OTHER PROCESSES; Albrecht F. von Groeling, New York, N. Y. App. filed Dec. 21, 1918. Distilling petroleum.

1,378,080. ELECTRICALLY HEATED BAKE OVEN; James C. Woodson, Mansfield, Ohio. App. filed Sept. 24, 1920. Reel-type oven.

1,378,082. AUTOMATIC CONTROL FOR ELECTRIC IRONS; Charles B. Yoder, Webster Groves, Mo. App. filed April 19, 1920. Prevents overheating.

1,378,094. METHOD OF AND MEANS FOR TREATING AIR; Egerton R. Case, Toronto, Canada. App. filed March 22, 1920. Humidifier.

1,378,095. ELECTRIC DEVICE FOR TREATING AIR; Egerton R. Case, Toronto, Canada. App. filed March 22, 1920. To humidify air.

1,378,120. METHOD OF AND APPARATUS FOR TREATING LIQUID; Clarence P. Landreth, Philadelphia, Pa. App. filed Dec. 20, 1916. Electrochemical treatment of waters.

1,378,126. RESISTANCE DEVICE; Harry C. Nagel, Wilkinsburg, Pa. App. filed May 14, 1915. Wire wound into series of integral compact sections.

1,378,137. HAIR-SINGEING MACHINE; Warren A. Ross, Haverhill, Mas. App. filed May 25, 1920. Electrically heated.

1,378,140. INSULATOR BRACKET; Warren B. Simpson, Huntingdon, Pa. App. filed Nov. 25, 1919. Pole-top three-pin.

1,378,145. ELECTROLYTIC DEPOSITION OF COPPER FROM ACID SOLUTION; Franz E. Studt, London, England. App. filed Aug. 14, 1917. Applicable to electroleaching processes.

1,378,146. ELECTRICALLY CONTROLLED TRANSMISSION; Max Taigman, New York, N. Y. App. filed May 17, 1918. For sewing-machine control.

1,378,151. ELECTRICAL TRANSFORMER; Chester H. Thordarson, Chicago, Ill. App. filed Nov. 6, 1916. Variable core.

1,378,170. REPEATER CIRCUITS; Lloyd Espenschied, Hollis, N. Y. App. filed Dec. 19, 1918. Telephone and telegraph.

1,378,187. FOCUS INDUCTOR FURNACE; Edwin F. Northrup, Princeton, N. J. App. filed Oct. 9, 1918. Heated by high-frequency current.

1,378,188. LADLE HEATING BY HIGH-FREQUENCY CURRENTS; Edwin F. Northrup, Princeton, N. J. App. filed Nov. 25, 1916. Also prevents piping in mold.

1,378,189. METHOD AND APPARATUS FOR MELTING OXIDES, ETC., WITHOUT CONTAMINATION; Edwin F. Northrup, Princeton, N. J. App. filed July 30, 1919. High-temperature melting and heat treatment.

1,378,192. ELECTRIC WELDING APPARATUS AND METHOD OF REGULATING THE SAME; Harry R. Pennington, Kansas City, Mo. Self-excited dynamo.

1,378,195. PIPE CAP FOR ELECTRIC CONDUITS; James C. Phelps, Springfield, Mass. App. filed Aug. 19, 1915. For outdoor use.

1,378,201. TERMINAL FOR ELECTRICAL PURPOSES; Elmer B. Stone, New Britain, Conn. App. filed Feb. 16, 1918. Fastened at end of insulated wire.

1,378,231. AUTOMATIC TELEPHONE SYSTEM; John H. Homrighous, Oak Park, Ill. App. filed March 10, 1919. Several exchanges.

1,378,247. ELECTRIC HEATER; Edwin N. Lightfoot, New York, N. Y. App. filed Jan. 31, 1920. Radiant.

1,378,256. ELECTRICAL HEATING APPARATUS; Maurice R. Malhomme, Paris, France. App. filed June 30, 1920. Melting pot.

1,378,266. PORTABLE ELECTRIC VAPORIZER; Henry Nagel, Davenport, Iowa. App. filed April 30, 1919. For disinfectants.

1,378,324. ELECTRIC HEATER; Charles A. Clark and Frank W. Blair, New York, N. Y. App. filed May 24, 1920. Soldering iron, laundry iron, stove top, etc.

1,378,345. METHOD AND MEANS FOR TRANSLATING ENERGY VARIATIONS; Ray E. Hall, Chicago, Ill. App. filed May 31, 1919. Periodic variations of definite frequency.

1,378,392. SIGNALING SYSTEM; Donald F. Whiting, New York, N. Y. App. filed Dec. 26, 1919. Talking and signaling currents.

1,378,454. ELECTRIC SWITCH; Charles T. Hentschel, Schenectady, N. Y. App. filed July 25, 1917. Ammeter switch.

1,378,461. METHOD AND MEANS FOR MAKING ELECTRICAL CONNECTIONS; Harry C. Hubbell, Cleveland, Ohio. App. filed July 12, 1920. Storage-battery manufacture.

1,378,467. LAMP SOCKET; Charles J. Klein, Milwaukee, Wis. App. filed Jan. 9, 1915. Push socket.

1,378,474. SAND BATH; Tiodolf Lidberg, Chicago, Ill. App. filed April 19, 1920. For physicians, surgeons and chemists.

1,378,477. ELECTRICAL FITTING CONNECTION; John A. McKay, New York, N. Y. App. filed Oct. 25, 1919.

1,378,511. ELECTRICAL SYSTEM OF POWER TRANSMISSION AND REGENERATIVE BRAKING; Clinton J. Axtell, Schenectady, N. Y. App. filed June 12, 1919. Electric railway service.

1,378,515. ELECTRIC HEATING DEVICE; Arthur F. Berry, London, England. App. filed Dec. 26, 1917. Perforated grids and bare resistance elements.

1,378,519. SUSPENSION FOR TROLLEY WIRES AND THE LIKE; George W. Bower, Schenectady, N. Y. App. filed Oct. 19, 1920. Insulated hanger.

1,378,526. MELTING FURNACE; Edgar F. Collins, Schenectady, N. Y. App. filed Jan. 10, 1920. For easily fusible metals.

1,378,547. RESISTANCE MEASUREMENT; Hendrik A. W. Klinkhamer, Hengelo, Netherlands. App. filed April 24, 1920. Modified Wheatstone bridge.

1,378,549. BATTERY; Arthur P. Manchester, Providence, R. I. App. filed Dec. 16, 1912. Gelatinous alkaline electrolyte.

1,378,552. ELECTRIC-HEATED THERMOSIPHON RADIATOR; Giovanni Monte, Turin, Italy. App. filed Dec. 20, 1919. Heat developed by electric resistances.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BELLOWS FALLS, VT.—Steps have been taken for financing improvements to the street-lighting system to cost about $5,000.

NORWICH, CONN.—The Legislature has adopted a bill amending the charter of the Eastern Connecticut Power Company providing for an increase in capital stock from $5,000,000 to $10,000,000. Part of the proceeds will be used for improvements.

Middle Atlantic States

BUFFALO, N. Y.—The Niagara & Erie Power Company is considering extensions to its transmission system at Lancaster, Hamburg, Depew, West Seneca and Cheektowaga. Transmission and distribution lines will also be extended to Dunkirk, Angola, Farnham, North Collins, Fredonia, Brant, Eden and vicinity. The cost of the project is estimated at $707,230.

ITHACA, N. Y.—The New York State Gas & Electric Corporation has applied to the Public Service Commission for permission to build an addition to its electric power plant at Plymouth, and make extensions to its system at this point.

NEW YORK, N. Y.—Preliminary plans are under way by the New York Edison Company for improvements and extensions to its two-story substation at 10-12 Elizabeth Street. William Whitehall, 12 Elm Street, is engineer.

ATLANTIC CITY, N. J.—A permit has been issued to the Atlantic City Electric Light Company to make improvements and to enlarge its plant at Missouri Avenue and the Thoroughfare. The cost of the additions is estimated at $150,000.

CAMDEN, N. J.—The board of directors of Cooper Hospital is considering rebuilding a portion of the power house at the institution, recently destroyed by fire.

NEWARK, N. J.—The installation of a complete new street-lighting in the city has been recommended by Harry R. Jackson, electrical engineer. The lighting service is furnished by Public Service Electric Co.

HARRISBURG, PA.—Bids will be taken at once, it is reported, for the installation of a new lighting system in Capitol Park for which plans have been prepared.

HARRISBURG, PA.—Dr. William L. Robb, lighting expert, has made a survey of the local light and power system and will submit report to the City Council for necessary improvemets and extensions.

SHARON, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 23 for conduits and wiring changes in the United States public building in Sharon, Pa.

CHESTERTOWN, MD.—Arrangements are being made by the Borough Council for the purchase of power plant and system of the Chestertown Light & Power Company.

WASHINGTON, D. C.—Bids will be received at the office of the general purchasing officer, Panama Canal, Washington, D. C., until June 23 for furnishing grab bucket, telephone cable, steel cable, watt-meter, heater cord, magnet wire, electric bells, receptacles, insulators, etc. Circular 1451.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing the following: Until June 14, Washington, Schedule 8174—6,000 ft. electric cable. Until June 17, Mare Island, Schedule 8226—2,000 ft. electric cable; Philadelphia, Schedule 8151—one motor-generator set and switchboard. Until June 21, Portsmouth, Schedule 8183—batteries and spares; various Eastern and Western yards, Schedule 8178—fifteen motor-generator sets. Until June 24, Puget Sound, Schedule 8165—electric wire and cable; Mare Island, Schedule 8224—33,000 ft. electric wire.

WASHINGTON, D. C. — The Potomac Electric Power Company, 231 Fourteenth Street, N. W., is considering extensions to its electric generating plant at Bennings to cost about $250,000.

North Central States

DETROIT, MICH.—The Board of Public Lighting Commissioners, 138 Atwater Street, has preliminary plans under way for the construction of a new power plant. Smith, Hinchman & Grylls, 710 Washington Arcade Building, are architects.

GRAND RAPIDS, MICH.—Petitions have been made to the Consumers' Power Company to extend its electric lines to villages of Comstock Park, Marne and Nunica.

MARSHALL, MICH.—At a special election to be held on June 28 a proposal to issue $100,000 in bonds for improvements to the municipal electric light plant, including the installation of a steam engine to supply power during low-water periods, will be submitted to the voters.

CLEVELAND, OHIO.—An ordinance providing for approximately $200,000 for enlarging and extending the municipal electric light and power system has passed its second reading.

PAINESVILLE, OHIO.—Plans are under consideration for extensions to the municipal electric plant to meet the increasing demands for electrical service.

LOUISVILLE, KY.—The Louisville Gas & Electric Company has secured a permit for the construction of a substation, 73 ft. x 87 ft., in the rear of 1467 South Third Street, to cost about $25,000.

BEECH GROVE, IND. — The Public Service Commission has approved franchise of the Indianapolis Light & Heat Company to install and operate a local electric street-lighting system,.

INDIANAPOLIS, IND. — The Indiana Power Company has applied to the Public Service Commission for permission to issue $1,000,000 in bonds, the proceeds to be used for extensions, etc.

INDIANAPOLIS, IND.—The Best Grand Laundry Company, Senate Avenue and Court Street, is considering extensions and improvements to its works to cost about $100,000. The plans include the construction of a new power plant and the installation of a water-softening plant.

RICHMOND, IND.—The Liberty Light & Power Company has applied to the Indiana Public Service Commission for permission to make an interconnection arrangement with the Dayton (Ohio) Power & Light Company for additional supply of electricity.

CHICAGO, ILL.—Installation of an ornamental lighting system on all streets in the loop is under consideration. It is proposed to use a combination trolley and lamp standard with a three-lamp arrangement on State Street and two lamps on the other streets.

FREEBURG, ILL.—Bids will be received at the office of the village clerk until June 23 for furnishing material and labor for improvements to the municipal electric light and power system as follows: Brick powerhouse building and machinery foundations, brick or concrete chimney, 100 ft. x 4 ft.; one 7-in. x 16-ft. H.R.T. boiler with shaking and dumping grates and horizontal breeching; one N.R.C. engine for direct connection to 120-kva. alternating generator, pump, heater, separator, steam trap, pipe, valves, fittings, covering; one 120-kva. direct-connected alternating-current generator with belted exciter; one 112½-kva. belted alternating-current generator and exciter; one four-panel switchboard; one 10-kva. series street-light regulator; station wiring; transformers, series street-light fixtures and line lightning arresters; poles, line wires, guys, pins, insulators, etc. Extra copies of the plans and specifications will be furnished upon receipt of six dollars to cover cost of printing. Fuller & Beard, Chemical Building, St. Louis, Mo., are engineers.

MINNEAPOLIS, MINN.—Electrification of the Electric Short Line and extension of the road from Hutchinson to Lake Lillian, it is reported, will be under way by July 1. The plans provide for replacing the gasoline motors now in use with electric power. The cost of the improvements is estimated at $1,000,000. W. L. Luce is vice-president and treasurer of the company.

LIBERTY, NEB.—A transmission line to cost about $6,000 will be erected to furnish electrical service in Liberty. Energy will be purchased from the Beatrice Power Company of Barnston.

NORTH PLATTE, NEB. — Steps have been taken by the Chamber of Commerce for improvements to the street-lighting system in the business section.

PHOTO OF PROGRESS ON MIDWAY STEAM PLANT OF SAN JOAQUIN LIGHT & POWER COMPANY. FIRST UNIT TO BE 12,500 KW. NATURAL GAS WILL BE BURNED

WESTPOINT, NEB. — Bonds to the amount of $58,000 have been voted for the construction of a municipal electric light and power plant.

Southern States

HENDERSONVILLE, N. C.—The installation of a lighting system on Main Street is under consideration.

SILVER CITY, N. C.—Arrangements are being completed for the development of a hydro-electric project on the Deep River.

WALTERS, OKLA.—The installation of an ornamental lighting system in the business district is contemplated.

CORPUS CHRISTI, TEX.—The electric light and power plant and the electric street railway of the Corpus Christi Railway & Light Company were recently disposed of. The former was sold to J. P. Connelly of Pittsburgh, Pa., for the sum of $50,000 and the latter to Claude Pollard of Houston for $500. It is understood that two new companies will be organized to take over and operate the railway system and power plant respectively. Extensions and improvements will be made.

HOUSTON, TEX.—The Houston Electric Company is considering improvements to its railway system to be made during next three or four years, to cost approximately $3,000,000, including power station, etc.

Pacific and Mountain States

GOLDENDALE, WASH.—The City Council has granted the Pacific Power & Light Company a franchise and has entered into a fifty-year contract for street lighting in Goldendale. The company, it is reported, contemplates extensive improvements to its electric transmission lines and generating plant on Little Klickitat River, 8 miles west of Goldendale.

TACOMA, WASH. — Bids will be received the latter part of June for the installation of a lighting system in the business section between A. Street and Yakima Avenue on Seventh, Ninth, Eleventh, Thirteenth, Fifteenth and Seventeenth Streets. Plans provide for luminous-arc lamps with cast-iron standards connected with underground cable. C. Lund, 402 City Hall, is engineer.

TOPPENISH, WASH.—The Pacific Power & Light Company, Portland, is considering the erection of an electric transmission line from Toppenish west to the McKinley school to cost about $9,000.

BELVEDERE, CAL.—J. M. Howells has applied to the State Water Commission for 300 sec.-ft. direct diversion and 200,000 acre-ft. from Deer Creek and Mill Creek, Tehama and Sacramento Counties, for power purposes. Diversion will be made by means of a dam, 20 ft. high, to develop 16,000 hp. The cost is estimated at $2,000,000.

EL SEGUNDA, CAL.—The installation of electroliers on the Boulevard is under consideration.

FRESNO, CAL.—The City Commissioners are considering an issue of $1,000,000 in bonds for the installation of fire-alarm systems, garbage-disposal plant and sewage improvements.

GROVELAND, CAL. — The Yosemite Power Company has filed application with the Federal Power Commission for permission to construct a dam and reservoir on the south fork of the Tuolumne River to develop 1,000 hp., and to construct a 7-mile conduit to a second power house at Wards Ferry to develop another 1,000 hp.

LOMITA, CAL.—A lighting district, it is reported, is being formed in this locality. Harry Phillips and C. G. Towne are interested.

MERCED, CAL.—The Original Mining & Milling Company has applied to the Federal Power Commission for authority to construct a 3,100 ft. conduit from the diversion dam in the Merced River to a power house developing 500 hp.

MODESTO, CAL.—Application has been made to the State Water Commission by Long Minor Pierce for direct diversion of 250 sec.-ft. from Dry Creek, Stanislaus County, for power purposes.

OXNARD, CAL.—Plans have been prepared for the installation of electroliers around Plaza Park.

PASADENA, CAL.—Plans are under consideration for placing all wires underground on East Colorado Street from Los Robles Avenue to old city limits.

KANAB, UTAH.—Negotiations are under way between the Dixie Power Company and the Commercial Club for the erection of an electric transmission line from Hurricane via Virgin, Rockville, Grafton and Springdale to Kanab and Fredonia, a distance of 46 miles. The cost of the line, including wiring of towns, is estimated at $50,000.

LAYTON, UTAH—The Utah Power & Light Company, Salt Lake City, has been granted a certificate of convenience and necessity by the Public Utilities to serve the town of Layton.

PRESTON, IDAHO.—The South Preston Irrigation Company, recently incorporated, has completed arrangements for the installation of an electrically operated pumping plant for irrigation purposes.

CASA GRANDE, ARIZ.—The Casa Grande Valley Electric Power Users' Association was formed recently to co-operate with the city to bring electricity from Sacaton to the Casa Grande Valley. The cost of the erection of a transmission line to Casa Grande, including transformers, motor-generator frequency changer set complete with switchboard, meter equipment and substation, is estimated at about $75,000.

Canada

CALGARY, ALTA.—R. P. Blakely, architect, Parliament Buildings, Edmonton, would like prices on equipment for power house to be built at the Technology and Normal School, Calgary.

ST. CATHARINES, ONT.—The installation of lamp standards on St. Paul Street from Burgoyne Bridge to Geneva is under consideration.